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A REPORT UPON THE BOREAL FLORA OF THE SIERRA NEVADA OF CALIFORNIA

BY

FRANK JASON SMILEY

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INTRODUCTION

The present paper constitutes a working flora for the high Sierra Nevada of California. It has been the intent of the author to present a list of all the plants now found within the higher portions of the Sierra with suitable keys for their determination. The reference to each species or variety includes the authority for the accepted name and reference to the place of publication together with a synonomy. There has been no effort to make the synonomy exhaustively inclusive, only those synonyms being listed which, in the writer's opinion, are apt to be met in the usually available literature and confused with the accepted name. Each specific or varietal reference in the list also includes the "type locality" where the plant was collected from which the original description was drawn; a statement as to the geographical range of the plant and one concerning its zonal position in the Sierra. The citation of all specimens examined by the writer has not been thought necessary; only those specimens are included which are believed to have some significance in showing the range of the plant within the limits of the Sierran region or to which attention is directed in the notes subjoined to many of the references. Prefixed to the Annotated List will be found sections descriptive of the geology, topography, and climatology of the range.

A few words should be added concerning the inception of the study now in part completed and acknowledgment made of assistance received from numerous friends. My interest in the plants of the Sierran region goes back to the time when, for a number of years, I lived the greater part of each year near the line separating the great forest belt from the higher mountains and found opportunity from time to time to make excursions into the summit region. Subsequently while a student at Stanford University and Assistant in the Dudley Herbarium, it fell to me to work over the collections made by the late Professor W. R. Dudley preparatory to their incorporation into the Herbarium. Dr. L. R. Abrams suggested the possibility of using these collections as a basis for an extended study of the high mountain floras of the state. The work then begun required the examination of other material than that in the Dudley Herbarium or preserved in the Herbarium of the University of California. Through the aid of the Harvard Club of San Francisco, I was enabled to spend a year and a half in Cambridge, working principally at the Gray Herbarium, where the types of many Californian and other western species are preserved. While at Cambridge, I had constant aid from Professor M. L. Fernald both in the critical examination of material and concerning questions of nomenclature; to his unfailing readiness to help much of whatever merit this paper may possess is due. At the same time, Dr. B. L. Robinson and Miss M. A. Day generously aided me in every way possible, besides affording me free access to the collections in their charge. While in the east, I was also enabled to visit the collections at the New York Botanic Garden and at the National Herbarium, in Washington. After returning to the Pacific Coast, residence at the University of California has permitted more detailed examination of the material in the Herbarium of the University, especially of the collections made by Dr. H. M. Hall and by Mr. and Mrs. Brandegee, and has afforded opportunity as well for conferences with them concerning localities, ranges, and special phases of the problems connected with the Sierran flora. While at Berkeley, I have also had the advantage of consultation with Professor W. A. Setchell and Professor W. L. Jepson, the latter loaning me material from his private collection. To all of the above named persons, and to Drs. D. H. Campbell and G. J. Peirce, of Stanford University, my warmest thanks are due and extended, as well as to a number of other botanists, and to friends living near the region the plant life of which is here considered.

The field work carried out in connection with the present report has involved visits of varying duration to several sections of the range, both for collecting material for herbarium study and for making field examination of the vegetation of selected parts of the range. The first of this series of visits was made in the summer of 1911 and the last in 1917. All sections of the Sierra Nevada have been visited except the extreme north in Plumas County, the Kern River region of Tulare County, and the eastern flank of the southern Sierra west of Owens Valley.

LIMITS OF THE SIERRAN REGION

California may be divided into six major provinces of which the Sierra Nevada region is the second in size. The boundaries of these divisions are not sharply defined, even the most clearly marked and largest division, the Great Central Valley, rising gently to the north and passing into the rolling foothills of the Klamath and Cascade mountain systems. Of the other provinces, the Sierran region is the best defined, being clearly limited on the west by the central valley and on the east by the fault lines which are the chief structural features of the range. The north and south limits are more or less arbitrary: at the north the metamorphosed sediments of the Sierra are seen to pass beneath the lavas of Lassen Peak just beyond the North Fork of Feather River and this stream may be adopted as the northern limit of the region.[1] At the south the normally horizontal Tertiary strata of the Sierra meet the folded sediments of like age belonging to the Coast Range at Tejon Pass, and this line of contact, which has been regarded as a fault, is generally accepted as the southern boundary.[2]

The distance between these limits is about 370 miles in a northwest-southeast line extending from the fortieth to the thirty-fifth parallel. In width the Sierran region is quite uniform: the distance from the Sacramento Valley on the west to Honey Lake, lying at the foot of the east slope in Lassen County, is about 80 miles, while near the southern end, the distance across the range, through the High Sierra, from the foothills bordering the valley of the San Joaquin east of Tulare Lake to Owens Valley, is nearly 70 miles. The rectangular region so defined has a base area of about 28,000 square miles.

The heights of the several crests of the range vary from 6,000 to 8,000 feet at the north and south limits to over 13,000 feet in the High Sierra, the average height of the watershed being approximately 9,500 feet. The ratio of the superficial area to the base area appears never to have been estimated and varies considerably in different parts of the range; in the mountains to the south of Yosemite Valley, a region of bold relief, the surface is comparable in ruggedness to that of the Alps and may exceed the base area by 60 to 100 per cent.

Nearly all of the area covered by the present report lies above the 6,500-foot contour line, with which, in the north, the lower limit of the

Canadian element in the boreal flora of the Sierra roughly coincides. All of the region lies within the State of California save the Carson Range just east of Lake Tahoe.

PETROLOGY

Both sedimentary and igneous rocks are included in that part of the Sierra Nevada which is inhabited by the boreal flora.

The sedimentaries are now reduced to isolated fragments of what was once probably a continuous terrane beneath which the intrusive magmas were irrupted. Most of the sediments date from paleozoic and early mesozoic time and are now for the most part metamorphosed to slates and schists. They are most abundant in the north, decreasing in amount southward as the general height of the range rises, and becoming restricted, in the high mountains, to the crests and summits save at a few exceptional stations where they appear to have formed massive blocks which sank in the still unconsolidated magma and have so been preserved from the extreme disintegration to which similar rocks at higher and more exposed situations have been subjected.

Included in the sedimentary rocks are shales, sandstones, limestones, and extensive areas of altered clastic rocks: schists, slates, and quartzites. The strike of the beds conforms to the trend of the range, that is, from northwest to southeast, but the dip varies. While in the Sierra as a whole the beds dip to the east, and generally at angles between 40 and 90 degrees,[3] in particular districts the dip is in the opposite direction, as at Mineral King in the mountains west of Mt. Whitney, where the beds dip to the southwest at an angle of 85 degrees.[4] The angle of dip has an important bearing on rock weathering.

The shales and their metamorphic products, slates and schists, contain pyrite which stains the outcrops in tones of red and yellow brown, causing them to stand out in contrast with the prevailing rock tint given to the higher mountains by the light colored granitic rock. In some places the slates are highly silicious, becoming converted to cherty rocks. In the valley of Fallen Leaf Creek, west of Lake Tahoe, there are exposures of dark colored banded silicious slates dipping nearly vertically. On the east face of Mt. Tallac and farther west on Jacks Peak, these same rocks appear. To the west and northwest of Lake Tahoe similar rocks are exposed, changed in places to schists carrying abundant mica, as on the northeast side of Ward Peak. In the region between the upper Tuolumne and the headwaters of Kings River, slate forms the summits of many of the higher peaks, as Mt. Lyell, and covers a considerable area west of the Sierra crest in the high mountains of Fresno County. Mt. Goddard and peaks to the west are of slate.[5] In the southern Sierra, slates and phyllites occur about Mineral King, Tulare County, in a belt some two miles wide and fourteen long. Kaweah Peaks, the highest summits west of the main crest in Tulare County, include the largest group of metamorphic sediments in the southern section of the range.[6]

Sandstones and quartzites are often found interbedded with the shales and slates but sometimes form isolated patches; the summit of Mt. Dana is a sandstone though the bulk of the mountain is slate and altered lava.[7] Quartzitic rocks occur in the Tahoe region near Suzy Lake and on the headwaters of Rubicon River in Rockbound Valley.[8] Quartz porphyry is exposed in the Mineral King region at 8500 feet elevation.[4]

Limestone is a rare rock in that part of the Sierra the plant population of which is considered in this report, but is found in lenses of varying size both in the northern and southern sections of the range.

The magmatic rocks of the Sierra Nevada include both intrusives and extrusives, the former being vastly in excess both in area exposed and in absolute amount. The intrusive rocks constitute the batholithic core of the range and were probably once completely overlain by the sedimentaries. The stratified rocks have now been reduced by erosion to a relatively small amount, exposing the granitic rocks which form far the larger part of the surface of the higher mountains, the region inhabited by the boreal flora.

The Sierran batholith contains several well defined rock species of granitoid type varying from normal granite to gabbro, its largest constituent being a rock of intermediate character between granite and diorite, known as granodiorite. This is the prevailing rock in a broad belt from Genessee Valley, in Plumas County, southward to the headwaters of Kings and Kern rivers. Granodiorite, as stated by Lindgren,[9] is distinguished mineralogically by having its soda-lime feldspar at least equal to twice the alkali feldspar. Analyses[10] of samples from different parts of the range indicate that this prevalent rock species maintains a fairly constant character throughout the Sierra. The analyses show the relation to granite and diorite, the two most nearly allied rock types; though less silicious than true granite, with respect to the silica content, it is distinctly nearer to granite than to diorite and, of course, still less resembles gabbro. The lime (CaO) content is high for a granitoid rock though here again granodiorite more nearly approaches true granite than the more basic plutonics. In color granodiorite is of a light gray tone varying according to the changing per cent of hornblende and biotite. The structure is medium to coarse-grained and crumbles easily to a coarse light yellowish-gray sand.

Associated locally in the north with the granodiorite is a rock approaching normal granite, granitite or biotite granite. In the northern section of the range, this rock is confined to the higher ridges and summits; in the southern Sierra it becomes more widely developed, and granodiorite is reduced in amount. The structure of the rock is coarse on account of the usually large alkali feldspar crystals. A large part of the Pyramid Peak Range, west of Lake Tahoe, is composed of this coarse granite. The immense sand slopes on the east side of Angora Peak, in the same district, have been formed by its decay. A large part of the crest about the headwaters of the Tuolumne and northward from Mt. Conness to the ridges about Highland Lakes and the Blue Lakes, in Alpine County, is composed of this coarse granite.[11] The same variety is found on the slopes of Mt. Whitney, the orthoclase prisms becoming 8 to 9 cm. long[12]; elsewhere in the country between Kern Cañon and the crest there is found a similar porphyritic granitite with pale flesh-colored crystals of orthoclase averaging 4 cm. in length over wide areas.[6] The fresh rock is harder and firmer in texture than the granodiorite, and the outcrops are more highly colored with iron stain.

Other granitic rocks of the high mountains include diorite, a dark green, medium to coarse-grained rock composed of green hornblende, a little black mica, and white soda-lime feldspar. Dioritic areas are not extensive but by no means uncommon, especially in the northern half of the range. The most basic of the intrusive rocks of the Sierra occurring in any quantity is gabbro; it is found in small patches, the total area of the gabbro exposures being vanishingly small as compared with the diorite, the least abundant of the rock types so far mentioned.

Rocks derived from extruded magmas still cover large areas in the north and on the western flank of the Sierra; in the southern mountains such rocks are less abundant within the high mountain region though present in certain districts. As is well known there appears to be a definite succession for the lavas which produced these volcanics. Rhyolitic flows preceded the more abundant andesitic extrusions, with basaltic lavas as the last member of the series. Residual portions of these consolidated lavas are to be found in the higher mountains capping the granite and sedimentaries. As a result of the sequence of the extrusions, the older lava rocks were buried beneath later products of eruption and become exposed as erosion removes the younger rocks. The soils derived from the weathering of these volcanics appear in bands along the sides of the valleys or encircle the summits in bands of irregular width.

Rhyolite, as it appears in the Sierra, is a light colored gray or pinkish rock, usually of fine grain but occasionally becoming vesicular; it is most abundant as a surface soil-forming rock in the central part of the range, as in northern Placer County about Soda Springs and Summit Valley, where it forms the country-rock over considerable areas. Andesite and andesitic breccias are present in greater amount than the rhyolite, which they overlie; they are present throughout the range and form the country-rock west and southwest of Lake Tahoe and also in the southern Sierra on the east slope of the range near the headwaters of Owens River. Andesite is reported[12] to be the surface rock of the crest between Owens River and the head of the North Fork of the San Joaquin. Near Mineral King large bodies of sheared andesite occur on Crystal Creek at 10,000 feet elevation.[4] In color andesite varies from dark gray to reddish. Like rhyolite, the andesite may be vesicular and in this condition weathers more readily than when fine grained; the breccias naturally weather more rapidly than the massive rock. Basalt is widespread in the Sierra and exposures are known in all sections of the range from Plumas County (Mt. Ingalls) to Tulare County, where the most recent extrusions appear to have taken place.[13] Basalt is generally darker and more compact than either rhyolite or andesite but in places becomes vesicular or scoriaceous.

In many places within the higher mountains there are surface rocks derived from lava rocks or tuffs through changes subsequent to solidification or deposition. Turner[2] believed that "it is now plain that the chief part of the rocks laid down on the geologic map as porphyrite and amphibolite schist are altered forms of original surface lavas and tuffs corresponding to modern basalts and andesites." Other alteration products of igneous rocks present in the Sierras include some serpentine, which is found on the crest of the Grizzly Mountains in Plumas County, and also on the Dardenelles in Alpine County.[3, 15]

A feature of high mountain rocks which has a most important bearing on their disintegration, and also on the vegetation growing on them, is the jointage. Over wide areas all the rocks will be found jointed, the slates and schists more minutely than the granites. In other places the granite appears perfectly massive. The joint planes sometimes appear to be in systems, coinciding in direction and angle over several square miles; in other places no such regularity can be made out. On the high summits and on the walls of cirques the rock is apt to be jointed in three planes, the whole being divided up into more or less cubical blocks, which are often freely movable on the exposed peaks and aretes. Becker[15] noted in the region north of Yosemite, where horizontal jointage predominates, that the granite mountains appeared somewhat terraced; in his opinion the fissures are really minute faults. In the Yosemite region Matthes[16] finds distinct areas of massive and jointed granites. On the south slope of Mt. Raymond, Madera County, the coarse-grained granodiorite is so regularly jointed that the blocks appear as if squared for rough masonry. On Kuna Crest, above Tuolumne Meadows, in the Yosemite district, the granodiorite is also regularly jointed. (See plates 1 and 3, showing jointage.)

TOPOGRAPHY*

While the present surface of the boreal region of the Sierra is highly diversified, in this complexity of topographic form are certain indications of a general symmetry. Viewed from a distance the inequalities appear to blend into fairly regular contours; plate 1 shows the summit region of the southern Sierra. This feature of the high Sierran topography has been studied in detail by Lawson[6] for the southern Sierra of Tulare County, and by Lindgren[17] and Reid[18] for the Tahoe district; the results of their investigations indicate an old erosion surface. Above this surface the highest summits of the existing range projected as a range of low mountains. With the progressive elevation of the region along the eastern margin, the result of movement along the fault lines differentiating the Sierra from the

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* The following maps ("quadrangles"), issued by the United States Geological Survey, cover the region considered in this paper. The sequence is from north to south. 1, Lassen Peak; 2, Honey Lake; 3, Bidwell Bar; 4, Downieville; 5, Sierraville; 6, Colfax; 7, Truckee; 8, Pyramid Peak; 9, Carson; 10, Markleeville; 11, Dardanelles; 12, Bridgeport; 13, Yosemite; 14, Mt. Lyell; 15, Mariposa; 16, Mt. Morrison; 17, Kaiser; 18, Mt. Goddard; 19, Tehipite; 20, Bishop; 21, Mt. Whitney; 22, Kaweah; 23, Olancha.

Great Basin, the rivers were rejuvenated and deep cañons trenched in the old plateau. The period of alpine glaciation in the Pleistocene widened many of these valleys in the higher mountains, giving to them the characteristic U-shape of glaciated valleys, and deepened the heads of these valleys by cirque cutting into the divides. The details of the surface now seen in the high Sierra Nevada are the results of this process of weathering and erosion upon the several terranes constituting the surface. The rock species weather differentially.

The small areas yet remaining in the high mountains of the early Mesozoic sedimentaries offer the most bizarre topographic forms, their minutely jointed and faulted condition making them peculiarly subject to the alpine erosional factors. Since, for the most part, they lie along or near the higher crests, many of the sharpest pinnacles and thinnest aretes are formed of these vestigial metamorphosed sediments; Mt. Ritter (13,096 feet), Red-and-white Peak (12,840 feet), the Palisades (14,000 feet), are conspicuous examples of many true dents along the crest. About their bases are slopes of scarcely altered rock débris of fairly uniform size, 2 to 3 inches in diameter.

Vastly more important in the topography are the granodiorite and granite areas. The latter rock disintegrates more abruptly than the granodiorite because of the usually coarse macrocrystalline texture. The rock becomes friable, crumbling to sand in which nearly fresh crystals of quartz and feldspar may be found. The resulting sand-slopes are a constant feature in the granite localities about Lake Tahoe and above Yosemite Valley, and Knopf and Thelen report the same thing for the Mineral King district in the southern Sierra. In crossing these slopes one sinks deeply. Since the fragments often lie at the angle of repose for such material, it is easy to start small slides which carry downward many of the plants found growing in such places. The upper reaches of these slopes are excessively dry and sterile, the large size of the constituent particles causing the pore space to be too great for capillarity to overcome. Water falling on the surface immediately sinks; there is no run-off in even the hardest showers. This absorptive quality of the upper reaches, with the attendant leaching effect, causes the lower levels to support a rich and varied flora of distinctly mesophytic shrubs and herbs, while at the bases marsh conditions may prevail.

The principal rock species of the range, granodiorite, is differentially affected by the forces of weathering accordingly as it is jointed or massive. The jointed rock is easily attacked by the erosional agents along the lines of fracture, becoming divided to a varying depth into more or less cubical masses. If the rise is abrupt, these in time fall from place and become aggregated into talus slopes at the foot of the cliff. In many places such talus slopes rise nearly to the summits and support a characteristic vegetation. Where the granodiorite is massive weathering is mainly a process of exfoliation producing rounded summits;[19] this is the origin of the many dome-like summits found in the higher mountains. Lambert's Dome, on the upper Tuolumne, Fresno Dome near Mt. Raymond, and Ralston Dome near Lake Tahoe (plates 6, 7), with surfaces bare of all vegetation except crustose lichens, are typical of many Sierran summits. Though theoretically the granodiorite should disintegrate faster than the granite because of its larger content of mica and soda-lime feldspar, the coarser texture of the granite makes this rock the weaker. This relationship of texture to weathering depends upon one important character of alpine rock decay: the dominance of mechanical over chemical forces at high altitudes. Solution plays a subordinate part because of the relative deficiency of water and carbon dioxide and of the lower temperature. On the other hand, temperature changes in the higher mountains are both of considerable range and frequent in time; the consequent expansion and contraction quickly shatters a macrocrystalline rock. Where water can penetrate the rock, as between mica foils, the disruptive freezing becomes especially effective.

The rocks derived from extrusive magmas—rhyolites, andesites, basalts—show the effect of these stresses; areas of andesite are characterized by heaps of conchoidal sharply angular stones riven by freezing from the parent rock and often cast for a distance of two or three feet.[20] Such débris frequently form a true shingle, the fragments overlapping each other and excluding all vegetation formed of higher plants, as on the east slope of Mt. Tallac.

Topographic form depends upon three factors: the character of the rocks, their position or structure, and the subsequent changes induced by weathering and erosion. The characters of the high mountain rock species in the Sierra have been indicated; since the mass of the sedimentaries as compared to that of the magmatic rocks is so small, the Sierra Nevada is properly considered as a range composed of igneous rock. This description is all the more true when reference is made to the region considered in this report. As a consequence the high mountain region is practically devoid of that type of structure produced by bedded rocks; nevertheless its structure is one of the most interesting features of the geology of the Sierra.

Sierran structure is determined by faulting and a number of well defined fault lines have been detected and traced for many miles, while other lines of displacement are suspected to exist. The fault lines trend northwest to southeast with displacement of varying amount. West of Owens Valley the total movement is thought to be not less than 10—11,000 feet;[21] the displacement is less in the north, amounting to some 3,000 feet in Plumas County.[22] In the Tahoe region there are three main lines of faulting, the two east and west of the Carson Range and the one on the west side of Lake Tahoe.[17] In addition to the great fault lines, there are within the range topographic details interpreted as the result of minor displacements.[15] Sierran faulting is of normal type, with small hade, large throw, and bold escarpments. Since, in addition to faulting, the region has also been revolved slightly on its long axis, the areas west of the fault plane are now tipped to the west and we find, almost without exception, that the west and southwest sides of elevations are of easy ascent compared to the more precipitous east and northeast sides. This structure and accompanying topography affect the vegetation, particularly that of the highest mountains, for this tilting of the range brings the surfaces near the crest line into the position most favorable for insolation, with its accompanying higher temperatures of both air and soil, and also for rainfall (compare rainfall of Fordyce and Tahoe on opposite sides of the Tahoe fault). It is true that not faulting only is responsible for the relatively low gradients of west and southwest as compared to east and northeast sides of elevations. These steeper sides unquestionably owe something of their greater abruptness to the fact that, as the leeward sides, the snow of winter drifts more deeply there while the opposite sides may be swept nearly bare. This deeper accumulation of snow, coupled with less melting because of lessened insolation, produced larger glaciers which cut their cirques deeper into the lee side of the ridges and summits. Today the only Sierran glaciers are on these protected slopes.

All the high mountain region has been more or less profoundly modified by the Pleistocene glaciation. Within that region the evidences of ice action are everywhere present. In the early period of the study of Sierran geology it was generally believed that this glaciation was much more severe than later investigations have shown to be the case. In the extreme north Diller[23] and Turner[24] found but slight evidences of glacial ice, as might be inferred from the relatively low altitude of the Sierra in Plumas County. Widespread evidences of glacial action are not found till the region of Gold Lake is reached in Sierra County. From this point southward to the Middle Kern, glacial phenomena give the tone to the high mountains.

The Sierran glaciers were, as a rule, controlled by the topography. In the Grizzly Mountains of Plumas County, Turner found evidences of the former existence of glaciers on eastern slopes but none on western or southern slopes. In the high Sierra of Tulare County, Lawson[6] noted that all evidence pointed to an ice control ''entirely of an Alpine type.'' In the district between Yosemite Valley and Lake Tahoe there was some approach to the continental type of glaciation with a summit neve-field sending glaciers down both flanks, but even here the highest summits remained above the ice. In the central Sierra both altitude and rainfall were sufficient to send tongues of ice down the valleys on the western slope to about 4,000 feet, and on the eastern to 6,000 feet. In the southern section the lower level reached by the ice at Mineral King was about 7,000 feet.[4] In Kern Cañon the trunk glacier ended just below the mouth of Coyote Creek at 6,450 feet.[6] It should be noted that these tongues of ice within the valleys reached far lower levels than the general glaciation and were able to reach such low altitudes only because of the great extent of the high mountain catchment areas; where such areas did not exist, the lower limit reached by the ice is less distant from the summits; in Plumas County Turner[24] found on the northeast slope of Grizzly Hill glacial débris somewhat below 6,000 feet, though the summit of Grizzly Hill, the highest point nearby, is but 6,424 feet. With the exception of some débris in Bucks Valley not recognized as certainly glacial, this Grizzly Hill glacier had the least elevation of any glacier known to Turner to have existed in the Sierra during glacial time. In other words, at the northern limit of the Sierra the ice failed to reach as low as in the central part of the range and but little lower than in the extreme south. On the main Sierran crest, Cirque Peak, ten miles south of Mt. Whitney, is the most southern point showing signs of glaciation.[6]* On the eastern flank glacial phenomena are of much less magnitude.

The topographic forms produced in the Sierra in this period of alpine glaciation are similar to those seen in other regions which have been subject to the same type of ice control. The upland surfaces were denuded of their soil and reduced in extent by cirque cutting at their periphery. In many places along the crests two cirques at the heads of glaciers moving normal to the divide have intersected and produced a col. The débris thus removed was deposited in the great moraines lying at from 5,000 to 7,000 feet, on the lower edge of the boreal region. These moraines are generally sharp-crested, of very regular contour, and often of huge size. The moraines of the Fallen Leaf Glacier southwest of Lake Tahoe are 1,500 feet high and three miles long. Morainal deposits also occur in the higher regions, frequently as ground moraine filling the bottoms of the high lying valleys, as in the valley of the Tuolumne at Tuolumne Meadows. The morainal matter is composed of coarse sand, cobblestones, and angular rock fragments loosely compacted to porous soil. Much of the surface from which this débris was taken now lies absolutely bare of soil, forming true rock deserts. ''Above this (morainal zone) extend vast stretches of bare rock surfaces, dazzling white smooth outcrops of granodiorite and reddish-brown slate areas.''[25] These denuded rock surfaces undoubtedly explain in part the relative poverty of the Sierra in the true ''alps,'' such as distinguish the Swiss mountains or may be found in the mountains of Washington and British Columbia. Plate 4 shows a typical glaciated valley in the central Sierra west of Lake Tahoe.

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* This for a long time was thought to be the most southern point showing glacial traces on the Pacific Coast. Recently certain obscure topographic forms on the north slope of the San Bernardino Mountains above 8500 feet have been referred to glacial ice,[26] a conclusion not concurred in by others who have examined the same region.[27]

Glacial phenomena in the higher Sierra Nevada are characterized by their fresh, scarcely altered appearance; the rock surfaces preserve their striae sharp and distinct and even so superficial a character as glacial polish is only beginning to disappear. Many years ago Russell[28] observed that the balance between the conditions favoring the formation of glaciers and those causing them to disappear is, in the region about Lake Mono, in nice adjustment. A slight alteration in the present climate would again cause the valleys to become filled with glacial ice, for to him it appeared probable that at no time in the glacial epoch could the climate of the Sierra have been of really arctic type. The glaciers were always controlled by the topography and the difference between the temperatures of the sun and shade sides of the ridges was, in his opinion, too small to cause such a control had the climate been truly arctic. A few years later G. F. Becker[15] called attention to the probable shortness of the time which has elapsed in California since the end of the Sierran glacial age: ''The period which has elapsed in California since the glaciers disappeared is a very brief one and the cañon erosion has no doubt been correspondingly small.'' Professor A. C. Lawson[6] says that very late in Quaternary time an epoch of alpine glaciation occurred in the Sierras and he considered 1,000 years to be a reasonable estimate of the time which passed since the ice left the basin of the Upper Kern. O. H. Hershey[29] has stated that in his opinion Sierran glaciation must have been short and comparatively recent, interesting for its alpine features but insignificant in the matter of geological time: ''In the Klamath region, I have not seen a trace of any glacial action older than the Wisconsin epoch and I have not heard of anything in the Sierra Nevada region which can be referred to the Iowan or any older glacial epoch.'' More recently, F. E. Matthes[30] has described the fresh appearance of the glacial evidences in the Yosemite district: ''It seems as if it were only yesterday that the ice had left them. Fresh and unweathered, like new quarries, are the cirque walls, while smooth, glassy 'glacier polish,' the result of long-continued grinding and 'sand-papering' by the débris-laden ice, still shines upon their bare rock floors.'' Matthes considers Sierran glaciation to have been recurrent, the last phase but recently ended: ''Indeed, in one sense it has not ended yet, for on the Sierra crest a few small ice bodies still hold their own. The uppermost cirques, there is good reason for believing, have only just been released from the dominion of the ice, but the lower canyons have been free for a considerable lapse of time and subject to normal weathering and stream erosion.''

Glacial scour and deposition produced such profound changes in the drainage that today the boreal region is preëminently a lake district. These bodies of water are of all sizes from mere pools but a few yards across to lakes several miles in length. They were long ago[28] divided into two classes: (*a*) those retained by moraines, and, (*b*) those occupying rock basins. The morainal lakes, for the most part, lie in and below the Canadian life-zone. The smaller rock basins are characteristic of the higher levels. The morainal lakes are being rapidly invaded by vegetation and changed into meadows onto which the forest advances, while the rock basins are nearly barren of plant life and are being very slowly filled. Around the lakelets of the higher region are usually found narrow beaches of white sand and just beyond the characteristic ''rock-ramparts'' formed of boulders of all sizes and walling in the basin. The relative immunity of the rock basins from plant invasion seems to depend in part upon the forces which form the rampart. The high mountain lakes freeze and thaw repeatedly during the year. After an ice cover has formed over the water, a sharp drop in temperature will cause the ice to contract and split, the cracks become filled with water from below and this water on freezing expands, causing lateral thrust upon the shores. The result of many such temperature changes is to drag the rocks upon the bottom or sides of the basin and ultimately shove them upon the beach.[31] This process impedes the development of higher plant life within the zone of drag. There is reason to think that the mountain lakes affect the local climates, a subject considered later.

The high mountain lakes are the catchment basins from which issue the brooks that unite to form the many rivers draining the boreal region. The drainage of the High Sierra may be divided into the channel drainage, which prevails below tree-line, and the surface drainage characteristic of the true alpine zone. In that zone the surface of the ground during spring and early summer is, as a rule, wet. The water derived from the snow-cover spreads out in the shallow soil or trickles over the rocks and this condition of saturation persists till the drifts are melted. Very gradually this percolating water is gathered into small rills that feed the lakes and form the sources of the great rivers of lower levels. With the disappearance of the snow-cover a complete change is effected; the shallow soil soon dries out, the small vernal pools disappear, and a period of aridity ensues only slightly ameliorated by the frequent light summer showers. The vegetation in this alpine zone is then subject to a wet and cold vernal period followed by a dry aestival phase. Near tree-line are the beginnings of definite water channels. The high gradient of the boreal region reduces all streams to typical mountain torrents broken by cascades and rapids.

Though mention has been made of a long axis of the Sierran region about which the whole range has been slightly revolved, there is no single crest-line throughout the summit region. In the north in Plumas County the range has three crests. The western crest runs from Bucks Mountain (7,231 feet) and Mt. Pleasant (7,111 feet) through Spanish Peak (7,047 feet) with a crest continuously above 6,500 feet; southeast from Spanish Peak the ridge line lowers, being below 5,000 feet for ten miles before reaching Clermont Hill (7,014 feet). Here the Middle Fork of Feather River cuts through this axis, which has its prolongation southward in the ridge, continuously rising to or above the 6,500-foot contour line that runs from the head of Camp Creek through Eureka Peak (7,490 feet) and Mt. Elwell (7,846 feet) to Sierra Buttes (8,615 feet). Between Clermont Hill and the northwest end of this Camp Creek-Sierra Buttes crest, the gap below the 6,500-foot contour is approximately nine miles wide. To the southwest of this interrupted height of land stretching from Bucks Mountain to Sierra Buttes there are a number of distinct summits and ridges rising to or above 6,500 feet—the very irregular crest north and east of Onion Valley and curving southeast to include Pilot Peak (7,505 feet) and Blue Nose Mountain (7,300 feet); the high ridges about Mt. Fillmore (7,816 feet) and Rattlesnake Peak (7,000 feet)—but they are separated by gaps of varying width and depression.

The second of these north Sierran crests begins with Houghs Peak (7,254 feet) and continues south through the Grizzly Mountains to Grizzly Peak (7,578 feet) with westerly offshoots to Mt. Jackson (6,625 feet) and Penman Peak (7,280 feet), south of which the upper Middle Fork of Feather River cuts through to its head in Sierra Valley. The third of the crest-lines is that which curves from Mountain Meadows through the summit of Diamond Mountain (7,000 feet) and Thompson Peak (7,752 feet), running southeast past Honey Lake and including McKesick Peak (7,083 feet) and Adams Peak (8,200 feet). This third crest has a higher crest-line than either of the other two but breaks down to below the 5,000-foot contour at Beckwith Pass, where a gap of ten miles separates the 6,500-foot contours on the north and south sides of the pass.

Of these crest-lines only the first may be said to be continuous with the high mountain region west of Lake Tahoe and this is intersected by the deep but narrow cañon of the North Fork of North Fork Yuba River. It has some significance for the study of the route by which the "Glazialpflanzen" invaded the Sierras that only on the northeast flank of this ridge are there well defined and extensive glacial deposits comparable to those found in the mountains of Nevada County and to the southward.

The discontinuity in the high level surface at the north of the range may have a bearing upon the colonization of the Sierra by representatives of the boreal flora; within the range itself, once the elevated region west of Lake Tahoe had been reached, these elements were less hindered in their gradual occupation of the country yet the progressive falling off in the number of species with high northern affinities seen in going from north to south suggests that within the range other gaps may occur across which the advance southward has been difficult. These gaps, in addition to whatever significance may attach to them in the study of plant distribution, are of interest to all who traverse the higher mountains, since advantage is taken of them to pass the divides and on the maps of the region they appear as passes, as Donner Pass, Tioga Pass. These places where the continuity of the summit region is interrupted are numerous but to only a few can much significance be reasonably ascribed as barriers to plant invasion from the north. The first depression which seems significant is that through which the railroad passes from Sacramento to Truckee (Donner Pass, 7,000 feet); a number of forms present in the northern Sierra do not appear to the southward. The second of these possibly significant depressions occurs about 120 miles to the southeast, intersecting the summit east of Yosemite Valley; Tioga Pass, 9,941 feet, breaks the continuity of the arctic-alpine life-zone for a distance of about three miles. The last gap reasonably to be considered as effective in this connection is some 25 miles southeast of Tioga Pass. This last pass has not been visited by me but Professor J. N. Le Conte describes[32] the High Sierra breaking down completely at Mammoth Pass (9,350 feet), where the crest consists of rolling hills and the forest belt crosses the range for a space of 20 miles.

CLIMATOLOGY

CLIMATE OF THE SIERRA NEVADA

The data bearing upon the climate of the higher Sierra, and especially of the region included within the limits of this report, are still so fragmentary that only general statements are warranted. The section across the range, through which the Central Pacific Railroad passes, has been longest studied and its central position permits certain general conclusions to be drawn concerning the climate of the Sierra as a whole. In very recent years there has been an increasing interest in the climate of the California mountains and numerous stations of record have been established.

The climate of the Sierra is conditioned by its northwest-southeast trend across the track of the winds blowing from the Pacific. All elements of its climate are affected by this geographic position.

TEMPERATURE

The area whose vegetation is here considered is surrounded on all sides by districts of much lower altitude and quite different temperatures. Within the high mountain region of the Sierra the similarities and contrasts in temperature follow as a consequence of its position paralleling the Pacific. The recorded temperatures of La Porte, in Plumas County, near the northern limit of the region, and of Summerdale, Mariposa County, in the southern half, are in close agreement (table 1). These stations are both well up in the Transition Zone. In the central Sierra, Cisco and Truckee are stations twenty miles apart but on opposite sides of the divide (table 2). An inspection of these curves indicates that north and south distance has but little influence on the local temperature; the northern station has a slightly lower mean monthly temperature throughout the year and monthly extremes a little below those of Summerdale. On the other hand, location on opposite flanks of the range shows a marked difference in the monthly extremes and a significant difference in the yearly means; Truckee is subject to winter minima far below the minima at Cisco, and to summer maxima exceeding those at the western station. The same relation is seen to exist between the temperatures at Tamarack and Bodie (table 3).

While very low minima or high maxima are not common in the Sierra Nevada, they are by no means unknown. Above the transition zone, minimum temperatures comparable to winter temperatures in the eastern United States are recorded from some district of the Sierra every season. The tables show the recorded extremes for a period sufficiently long to give some conception of the probable range. Data about winter minima from the very high mountain region are available from only three points. On Mt. Rose,[33] 10,800 feet, the highest but one of the peaks in the Carson Range, during the years 1905–06, 1906–07, instruments recorded a minimum for the first year of — 5° F.; for the second, — 10° F. On Mt. Lyell, 13,090 feet, a minimum thermometer was left for two years—July 1897 to July 1899.[34] The lowest temperature for the first winter was — 13.6°, and for the next, — 17.6° F. On the summit of Mt. Whitney,[35] maximum and minimum thermometers left in September, 1909, showed a record of 55° and — 23°, respectively, when read on May 24, 1910. They were reset on September 26, 1912 and by the following spring, a maximum of 65° and a minimum of — 35° had been recorded. The data given in the temperature tables show that minima, comparable to these from the highest peaks, are annual or nearly so, at Tamarack and Bodie, some four to six thousand feet nearer sea level.

The daily range of temperature in the High Sierra appears, from the data at hand, to be considerably less than has been reported from other similar regions in different parts of the world. A comparison of the local climates of Summit (7,017 feet) and of Tamarack (8,000 feet), made for the purpose of determining what effect a difference of 1,000 feet might have on temperature, disclosed that for the period of record, eight years, the greatest daily range of temperature observed in each month was as follows (data arranged in the order of months from the first of the year):

Summit	35	46	31	30	39	43	47	48	48	50	45	42
Tamarack	64	64	54	58	46	50	47	48	58	54	48	52

There are a few observations which tend to show that the daily range of temperature in the alpine region of the Sierra follows the general rule for alpine climates with a maximum near noon and low night temperatures. At Mountain Camp, 11,600 feet, near Mt. Whitney, during the twelve days between August 22 and September 2, 1881, inclusive, Langley[36] found the temperature averaging at

8:15 A.M., 41.0° F.
12:35 P.M., 56.7
8:15 P.M., 30.6

On the summit of Mt. Whitney at the beginning of September he found day maxima of 62.5° and morning minima of 22.5° F.; the coldest period of the day was between 3 and 6 A.M. On the same summit on July 8, 1903 the temperature rose from 51° at 9:30 A.M. to a maximum of 55° one hour later.[37] The daily range of temperature suggested by these meager data is far less than the daily ranges reported from other alpine heights, nor does this small range appear to be too exceptional. From a study of conditions on the summit of Mt. Rose, Church[38] concludes that "The most notable characteristic of the temperature on the summit is the smallness of the mean daily range."

The summer summit temperatures recorded from Mt. Whitney are supplemented by data from Mt. Rose; on this peak from June 29 to August 4, 1905, the extremes were 24° and 72° F.; between August 4 and September 4, the maximum was 70.8°. The following year similar periods showed minima of 22° and 29.5° and maxima of 71° and 68.8°.[38] These summit data appear to show that as far as temperature extremes go the Sierran alpine heights are subject to about the same winter extremes and summer minima as stations thousands of feet below but that their summer maxima fall far short of the maxima of lower levels.

Inspection of the graphs (table 3) of the monthly extremes for the three stations—Summit, Tamarack, and Bodie—shows that even in the Canadian, the lowest of the boreal life-zones, all months are subject to frost; little significance is to be attached, however, to the rubric ''killing frosts,'' when referring to high mountain stations, for the sufficient reason that though the plants may be frozen they may still survive.[39]

RAINFALL

Though the Sierra Nevada lies to the south of the majority of the storms entering the continental atmosphere from the North Pacific area, the position of the range, athwart the track of the moisture-bearing winds blowing landwards, ensures to the western side of the mountains sufficient rain not to exclude tree growth away from the water courses, even at the base of the mountains except near the southern end of the region. The Blue Oak (*Quercus Douglasii* H. & A.), the Interior Live Oak (*Q. Wislizenii* A.DC.), and the Digger Pine (*Pinus Sabiniana* Dougl.) grow on the foothills east of the central valley but little above the valley floor. On the eastern flank no such lowering of the ''dry tree-line'' exists; west of Honey Lake, Lassen County (3,849 feet), this line runs at about 2,500 feet above the lake, rising southward to near 8,500 feet west of Owens Valley. The rainfall on both flanks constantly diminishes to the southward:

Western slope stations:		
La Porte, Plumas County, 5,000 feet	89.2	inches
Bowmans Dam, Nevada County, 5,500 feet	75.6	''
Blue Cañon, Placer County, 4,695 feet	74.2	''
Crockers, Tuolumne County, 4,452 feet	55.0	''
Summerdale, Mariposa County, 5,270 feet	55.1	''
Tehachapi, Kern County	10.62	''
Eastern slope stations:		
Truckee, Nevada County, 5,819 feet	27.1	''
Taboose, Inyo County, 6,200 feet	14.0	''
Bairs, Inyo County, 6,100 feet	8.7	'' [40]

This difference in the mean annual precipitation between the windward and leeward sides of the range is even more clearly seen by comparing nearby stations:

West side: Bowmans Dam, 5,500 feet	75.6	inches
East side: Boca, 5,535 feet	20.14	''

The altitude of greatest rainfall in the Sierra is between 5,000 and 6,500 feet on the western flank. The line for a time rises to the southward, the higher mountains of the southern half of the region appearing to cause an increased rainfall at a constant level. The rainfall of the summit region varies from about 70 inches in Plumas County to 47 inches at Summit and probably 40 to 30 inches west of Owens Valley. Above the zone of maximum rainfall on the western slope there appears to be a fairly constant decline with increasing altitude, amounting to 0.40 inches per 100-foot rise. On the eastern slope the crest is the altitude of greatest rainfall and there is a constant decline to the floor of the Great Basin and of Owens Valley. Between Summit and Boca the rate of decrease is approximately 1.85 inches per 100 feet of descent. In the southern Sierra, Lee[40] found the rate to be about .40 inches per 100 feet.

The rainfall of the Sierra is markedly seasonal; winter has the maximum amount and summer the minimum. In this strict seasonal distribution of precipitation the Sierra is peculiar among the high mountains of western America. Table 4 shows the graphs for representative Transition and Boreal stations. There appear to be two winter maxima: a major in January and a minor in March. Aside from the small amount of rain falling on the eastern side there is the further difference that this amount is more evenly distributed throughout the year; the graph for Bodie is flatter than that of any other station. A feature of the high mountain rainfall, contrasted with that of the Transition life-zone, is the more copious summer showers; at LaPorte and Summerdale, July and August are practically rainless, while Bodie has over half an inch and Tamarack nearly an inch in July.

SNOWFALL

Records of snowfall in the Sierra from the central division cover a period of over forty years; at Summit there is a continuous record since 1870. At that station 86 per cent of the total precipitation falls as snow.[41] The total seasonal fall varies within wide limits about a mean of 443.5 inches. During the period of record at Summit the extremes in five seasons were:

Maxima		Minima	
1879–80	783.0 inches	1880–81	153.5 inches
1889–90	776.0 "	1884–85	202.0 "
1894–95	685.0 "	1888–89	261.0 "
1892–93	634.0 "	1897–98	262.0 "
1906–07	602.0 "	1882–83	299.0 "

These maxima are among the largest, if not the largest, ever reached in the United States.[42]

At Summit, during a period of thirty-five years, July was the only month with no snow. August showed only a trace in one year. The snow season begins in September but, throughout that month and the next, snow melts as fast as it falls, the snow-cover not appearing till the first week in November. This appearance of the ground-cover normally marks the beginning of winter and the complete cessation of the vegetative period—at least for herbs and low shrubs, as its disappearance marks the beginning of the local ''spring'' for these plants. The cover increases to a maximum in March when melting becomes dominant and thereafter the snow-cover diminishes steadily to zero in the first ten days in July (table 5).

The snow-cover plays such an important part in the biology of the high mountain region that its fluctuations are of considerable moment. The graph presented in table 5 shows the normal accumulation and dissipation of the snow-cover at Summit. The data given below show the average condition of the surface, at the first, middle, and end of each month, from the beginning of the snow season to the snow maximum in March, and, at the right, the varying condition of the surface observed once or oftener on the same dates (data in inches). Period, 1906–07 to 1917–18 inclusive.

	Nov.	1	8	9	0	6	0	32	0	34
Fordyce Dam	Dec.	9	28	39	0	35	0	60	0	74
Nevada County	Jan.	40	75	85	0	69	15	100	8	161
6,500 feet	Feb.	86	91	103	9	158	27	157	44	154
	Mar.	111	108	103	45	165	58	154	67	154
	Nov.	2/3	9	11	0	4	0	47	0	32
Summit	Dec.	10	27	40	0	31	0	70	0	32
Placer County	Jan.	44	93	118	0	87	26	178	2	218
7,017 feet	Feb.	118	117	121	2	228	27	240	23	215
	Mar.	127	137	115	26	222	38	276	50	262
	Nov.	7/10	13	13	0	6	0	55	0	29
Tamarack	Dec.	17	39	53	0	55	0	101	8	125
Alpine County	Jan.	60	107	145	8	125	25	178	20	274
8,000 feet	Feb.	154	163	170	20	320	45	407	42	434
	Mar.	176	180	172	44	443	79	440	62	338

Summarizing the data for this element of the high mountain habitat, we note that on the first of November, at all three stations, the ground may either be bare of snow or may already have received the beginning of the snow-cover. At all three places in the majority of years, the ground has not yet received its winter blanket by November first. By the middle of November, in the majority of years, a light covering of snow has appeared though in exceptional seasons the ground may still be bare (in the twelve years, this occurred five times at Fordyce Dam, four times at Summit, three times at Tamarack). By the end of November, at all three stations, the ground has become covered except in very exceptional years (in the period under consideration, the ground was bare of snow at the end of November in two seasons at Fordyce and Summit, and once at Tamarack). The beginning of December found the ground bare of snow once in the period at all three stations and in the same season, that of 1907–08. An extraordinary condition occurred in December, 1907, at Fordyce and Summit, where, at the end of the month, no snow lay upon the ground and but eight inches was present at Tamarack, 1,000 feet higher. Even January first has found the ground at Fordyce free of snow (season of 1910–11) and Summit with but four inches, though Tamarack reported two feet. The winter of 1917–18 was unprecedented in the failure of precipitation; January first saw no snow at Fordyce and Summit and but eight inches at the highest station. Even as late as the first of February in this winter there were but two inches of snow at Summit, a snowfall of over two feet which had occurred about the middle of January having been almost completely melted or evaporated.

The conditions at Summit appear to be fairly typical for the Canadian zone throughout the Sierra. Melting of the snow-cover proceeds at the rate of four inches per day at the middle of May. At the beginning of June, 1911, there was about 38 inches of snow at 6–7,000 feet; by the twelfth, bare ground was visible in spots, and within a week all snow was gone except in north-facing ravines and on the higher peaks.[41] Here snow may linger till late in summer or, after years of exceptional snowfall or in unusually cold summers, persist in drifts throughout one season. Very rarely does such a drift survive a second summer. On the summit of Mt. Whitney, snow drifts among the summit rocks last till the first of September.[37]

Unfortunately there is no Hudsonian station, but the record at Tamarack throws some light on conditions in the higher zone. The snow-cover appears at Tamarack in the latter half of October; by the last of that month, on the average, 30 inches of snow has fallen and winter has begun. ''Spring'' comes in the first or second week of July; by the middle of the month, the ground at 10,000 feet is commonly free from snow; the first of August finds only patches and drifts in sheltered places.

From the studies of J. E. Church[43] it appears that the density of the snow-cover increases with altitude and method of deposition, i.e., whether wind-laid or in sheltered drifts. At 8,000 feet in Jones Pass on Mt. Rose, Church found a protected drift with a density of 26.6; at the summit (10,800 feet) a wind-laid deposit showed a density of 39.5. The weight of the snow-cover mechanically influences the growth-forms of high mountain plants. This weight increases as the season advances and is greatest near the end of March, when melting has begun to raise the water content of the snow. At Summit in January, 1916, weighings made on the twenty-fourth and twenty-seventh of different levels in a cover of 168 inches showed increasing weights per cubic foot as follows:

First cubic foot (surface)	10 lbs.
Three feet from surface, cubic foot	14 "
Six feet from surface, cubic foot	18 "
Ten feet from surface, cubic foot	22 "
Bottom of cover, cubic foot	28 " [44]

In March the water content of the snow has greatly increased and the bottom of the cover is a slush that weighs heavily upon the vegetation beneath; in March, 1916, the cover was ten feet thick, the first foot contained 56 per cent of water; at the depth of five feet the snow was 63 per cent water, and at the bottom, 66 per cent.

In the boreal region snow conditions are complicated by several factors: the diminished precipitation decreases the total snow; the usually bold relief favors the accumulation of drifts on lee sides of peaks and crests but increases the power of wind to sweep large areas bare; the increased direct insolation plus the large amount of heat reflected from the snow-fields below often causes the high peaks and ridges to exhibit spring phenomena before the lower levels.

The relative effect of protection from wind and sun is indicated by certain measurements taken at Tahoe City (6,225 feet) in the winter and spring of 1910:[43]

	Treeless Meadow	*Pine-Fir Forest*	*Fir Forest*
Jan. 7	snow 24.6 inches	23.8 inches	25.0 inches
Jan. 19	41.6 "	40.4 "	......
Mar. 11	29.8 "	31.4 "	30.4 "
Mar. 21	20.0 "	24.0 "	24.5 "
Apr. 10–13	0.0 "	Apr. 20 1.3 "	Apr. 20 7.1 "

At the beginning of the period the three types of surface had approximately equal amounts of snow; at the end the meadow had been bare a week, the mixed forest retained about 3 per cent of its maximum, and the denser fir forest 25 per cent. Still more indicative of the comparative aridity of open slopes, this time for the alpine zone, are the comparative measurements made on a talus slope and on a forested slope on Mt. Rose:

Talus slope (unforested):		
Slightly protected slope below observatory	52.5	inches
Wind-swept slope	8.1	''
Protected slope	78.1	''
Average of talus slope	40.8	''
Forested slope	88.6	''

The influence of the snow-cover on the seasonal temperature is well brought out in the curves for stations on the opposite flanks of the range. The eastern side, deficient in rainfall, has winter temperatures below the western slope; with the return of spring there is required less heat to melt the accumulated snow on the eastern side and the monthly means for spring are higher than on the Pacific side. That this milder spring temperature on the leeward side is due to the lessened amount of heat required for melting is borne out by the fact that, as soon as the snow-cover is melted from the western flank, its mean temperature immediately rises above that of the desert side. It will also be noted that in winter, when no melting occurs, the western side is the warmer (tables 2 and 3).

Data concerning relative humidity in the higher Sierra Nevada are extremely meager and somewhat contradictory. McAdie[45] observed that on Mt. Whitney, ''During the mid-day hours the humidity would rise as a rule to above 80 per cent, while between 2 P.M. and 5 P.M. extremely low humidities were recorded, ranging from 3 to 11 per cent.'' This diurnal change in the content of atmospheric vapor with a maximum about noon followed by cloud formation and rain in the afternoon is normal for all high mountain climates.[46] McAdie also noted that there were ''marked changes in short intervals in the amount of water vapor present,'' a characteristic of the alpine climate.* In August, 1913, the condition of atmospheric humidity in the high mountains west of Lake Tahoe was comparable to that observed by McAdie. At Glen Alpine Springs, Eldorado County, the humidity would increase hourly to a maximum about 2 P.M., a heavy shower of rain or hail would sweep across the country and, thereafter, the water vapor in the atmosphere rapidly diminish. It is somewhat surprising to find Langley's observations, made also in the high mountain district of Tulare County, at considerable variance with the later report: during his twelve-day stay at Mountain Camp, near Mt. Whitney, he noted mean humidities as follows:

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* L'humidite relative est sujette en montagne aux variations les plus brusques et, en apparence, les plus capricieuses. Ces variations augmentent avec l'altitude. A des periodes de secheresse, où, la perce gerce et les ongles cassent comme dans un desert, succedent, avec une bouffée de vent ascendent, des brouillardes penetrants.''[47]

8:15 A.M.	27.6 per cent
12:36 P.M.	20.6 per cent
8:15 P.M.	40.9 per cent

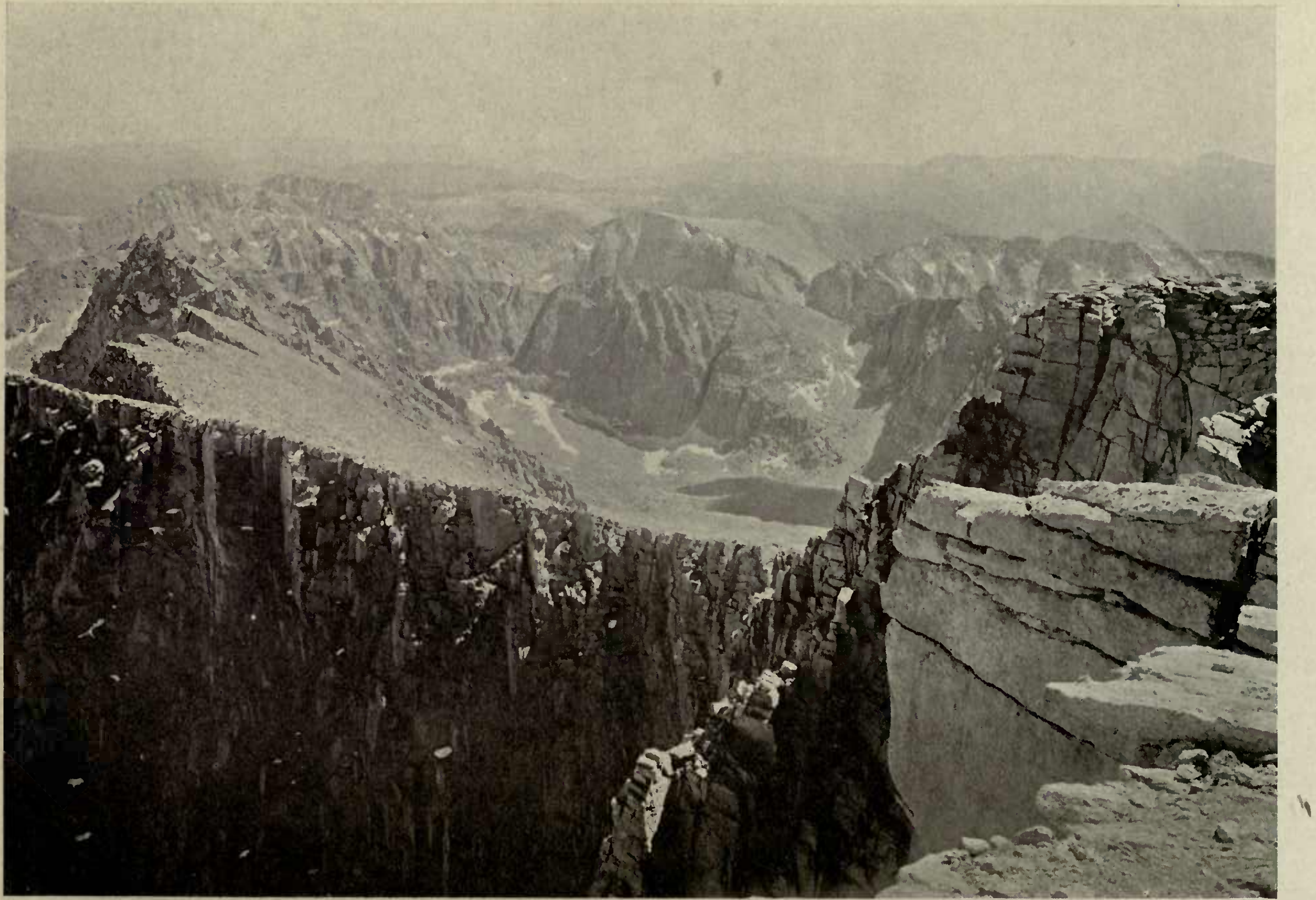
In this period the absolute maximum was 67.5 per cent at 8:15 P.M. and the minimum at 8:15 A.M. was 4.4 per cent. The evening maximum decreased as a rule during the night, though some of the mornings showed high humidities; he found no evidence of a regular midday maximum. "That no such law was observed on Mt. Whitney is again to be attributed to the extraordinary dryness of the climate."[36]

In the Sierran boreal region the sky is distinctly more cloudy than at lower levels:

Emigrant Gap,	5,230 feet,	clear days 241.8;	part cloudy 24.0;	cloudy 96.5
Cisco	5,939 feet,	clear days 273.2;	part cloudy 5.0;	cloudy 86.5
Summit	7,017 feet,	clear days 226.2;	part cloudy 11.1;	cloudy 122.7
Tamarack	8,000 feet,	clear days 189.2;	part cloudy 78.8;	cloudy 99.5

This increase in cloudiness in the higher mountains is a sequel of the rapid change in atmospheric humidity noted above and is characteristic of alpine climates.

Wind in the higher mountains is a major element in the climate. It affects the plant population both indirectly as modifying the soil and directly by its importance as an agent in the distribution of propagative bodies and through its formative influence upon the growing plant. In the Sierra the prevailing winds blow from the west or southwest, the storm winds, particularly, blowing from that direction. There is some difference between the two slopes of the range with regard to the constancy of wind direction; on the western slope the air movement will be constant for days or even weeks at a time (disregarding those minor air movements determined by topography noted below); on the eastern slope there is less uniformity of direction, though the prevailing wind is still the west wind, yet occasionally winds of considerable velocity blow from the desert. In the boreal



ARCTIC-ALPINE ZONE, SUMMIT REGION SOUTHERN SIERRA NEVADA: VIEW SOUTH FROM THE SUMMIT OF MT. WHITNEY, TULARE COUNTY.

region the force and direction of the wind are the controlling factors in giving shape to the vegetation. The velocity of the winds increases with altitude. On the summit of Mt. Rose the velocities of 40 to 50 miles per hour have been recorded.[33] In the spring perpendicular winds (Chinook winds) may occur which rapidly melt the snow from the higher altitudes. In addition to these general winds there are ''mountain and valley winds,'' day and night currents, induced by diurnal and nocturnal temperature changes on the higher peaks and ridges, which flow up and down the gorges, at times attaining considerable force if the topography favors convergence of several minor currents into a general movement. The valley or night wind flowing down the slope undoubtedly plays a part in plant distribution; just what, if any, importance in this connection is to be attached to the feebler ascending day current is obscure.

An account of the climate of a region with so diversified a topography as that of the Sierra Nevada must take cognizance of the fact that in only a very general sense is there a climate of the region as a whole; rather, there exists a number of local climates determined by position. In the case of the Sierra, with its contrasted flanks, the complexity becomes all the greater. It is apparent to even the casual visitor that the vegetation is unlike in different parts of the range; on either flank there is a change with altitude and a significant difference exists between the flanks in the aspect of the vegetation. The general characters of the high mountain climate have now been given but it has also seemed possible to arrive at some more definite understanding with regard to the unlikenesses in the plant life of the range by making a study of the climates of certain stations known to possess distinct assemblages of plants.

The data are supplied by publications of the Weather Bureau in which information is given concerning the mean monthly temperatures, the monthly extreme temperatures, amount of precipitation, amount of snow upon the ground at the end of each month, number of rainy, clear, part clear, and cloudy days, and the prevailing direction of the wind. In order that the effect of the climatic elements, as modified by position and topography, should be comparable and serve as the basis for deduction about the vegetation, it is obvious that the data should meet certain conditions: the stations should be as close together as possible and still possess those contrasts in position and topography which may be presumed to influence the local climate; the data should cover the same years.

The five stations selected, their geographical position with respect to each other, and the distinctive character of the local topography, are:

(1) Summit, Nevada County, 7,017 feet elevation, lies at the top of the divide, about 300 feet above Summit Valley and nearly 1,100 feet above Donner Lake (5,939 feet), a glacial lakelet three miles long, draining into Truckee River. Lower Canadian life-zone (*Pinus Jeffreyi* the characteristic tree).

(2) Fordyce Dam, Nevada County, 6,500 feet elevation, and about nine miles northwest of Summit. The station lies just below Fordyce Lake, a small glacial lakelet receiving drainage from the northwest side of Castle Peak and the southwest slopes of Mt. Lola. The lake lies 1,500 feet below the divide, on the western slope of the range, and drains into the South Fork of the Yuba through Fordyce Creek. The zonal position is middle Canadian (*Abies magnifica* and some *Pinus Murrayana* on the slopes above the lake.)

(3) Tamarack, Alpine County, 8,000 feet elevation, lies on the headwaters of the Mokelumne River in a glaciated region with many small lakes, the largest being the Blue Lakes, two glacial basins, each about one-half mile long. The station is distant from Summit about 50 miles to the southeast and is in the upper part of the Canadian life-zone (*Pinus Murrayana* dominant tree).

(4) Tahoe, Placer County, 6,230 feet elevation, lies on the northwest shore of Lake Tahoe, the largest lake of the Sierran region, some 21 miles long and 12 wide and very deep; it never freezes over in winter. The main divide of the Sierra lies six or seven miles west of the station and the crest is 2,500 to 3,000 feet above the lake. Transition life-zone (*Libocedrus decurrens, Abies concolor,* some *Pinus ponderosa*).

(5) Bridgeport, Mono County, 6,500 feet elevation, lies on the east side of Bridgeport Valley, a large mountain valley nine miles long and four wide at the widest part, drained by the East Walker River and receiving the drainage from the east slope of the Sierra through Big Buckeye and Robinson creeks as well as some small amount from the arid mountains north of Mono Lake. About 95 miles southeast of Summit and in the upper Sonoran life-zone near the boundary of the Transition.

The data studied cover the years 1914–1917 inclusive. This quadrennium has been chosen for study since data from all five stations exist for this period only. Inspection of temperature data shows that the means of the quadrennium differ but slightly from the means of much longer periods at three of the stations and that the maximum variation, a December excess of 6.4° over the mean of the 12 years' record, occurred at Tamarack. In no other monthly mean throughout the year is the variation half as large. It is believed that deductions made from the data of this period concerning the local climates of the several stations are not invalidated by the brevity of the record.

The diagram summarizes the relative temperatures of the several stations and shows that in the coldest part of the year Summit is the warmest station though the highest in altitude of any except Tamarack.

Diagram Showing the Relative Position of Each Station as Determined by its Mean Monthly Temperature; Warmest Station at the Top, Coldest at Bottom.

Jan.	*Feb.*	*March*	*April*	*May*	*June*	*July*	*Aug.*	*Sept.*	*Oct.*	*Nov.*	*Dec.*
Summit	Summit	Summit	Bridgeport	Bridgeport	Bridgeport	Bridgeport	Tahoe	Summit	Summit	Summit	Summit
Fordyce	Fordyce	Fordyce	Tahoe	Tahoe	Summit	Summit	Summit	Tahoe	Tahoe	Tahoe	Tahoe
Tahoe	Tahoe	Tahoe	Fordyce	Summit	Tahoe	Tahoe	Bridgeport	Bridgeport	Tamarack	Tamarack	Fordyce
Tamarack	Tamarack	Tamarack	Summit	Fordyce	Fordyce	Fordyce	Tamarack	Tamarack	Bridgeport	Fordyce	Tamarack
Bridgeport	Bridgeport	Bridgeport	Tamarack	Tamarack	Tamarack	Tamarack	Fordyce	Fordyce	Fordyce	Bridgeport	Bridgeport

The data given in the temperature table (table 7) shows that little difference exists in the first month of the year between the mean temperatures of Summit and Fordyce, the slightly higher mean temperatures of Summit being due to the fact that, though the monthly maxima are never as high at this season as at Fordyce, the monthly minima are always higher than at the lower station. That this relatively mild late winter at Fordyce is not due to its comparatively low altitude is shown by comparison with Bridgeport which, at the same altitude, is the coldest of the five stations. Indeed, this contrast between localities of equal altitude but on opposite sides of the range is observed within much shorter distances than that separating Fordyce and Bridgeport. In the quadrennium here considered, Tahoe, though 270 feet lower than Fordyce, has a lower mean temperature through January, February, and March, and practically the same mean temperature in April; not until May is there much difference between the monthly means of Fordyce and Tahoe in favor of the latter place.

Study of the diagram indicates that, as the year advances, Fordyce becomes relatively colder until in late summer and early fall it is the coldest station of the series. On the other hand, Bridgeport, the coldest station through all the winter months (November to March) becomes the warmest station immediately after the end of the winter precipitation season. The vegetation at Bridgeport passes from a mean monthly temperature in March, 7.3° below freezing, to a mean temperature 7.8° above the zero point, in April. The diagram shows that at no other point is the transition to the vernal season so abrupt. Plant physiologists are agreed that vegetation may endure considerable absolute range of temperature with less injury if the change be graduated over a period of some length than an abrupt change of less absolute amount. The gradual change in the position of Fordyce in spring and summer has been referred to; in the fall this locality again shows a relative rise. The temperature element in the local climate of Fordyce has a yearly range the most moderate of any of the stations; it is the only locality where minima less than freezing are not recorded while its summer maxima are no higher than those of Tahoe. The ratio of the mean of the coldest month to the mean of the warmest month at Fordyce is less than at any other station—100:184.5.

A study of the temperature conditions at Tahoe shows, as indicated in the diagram, that this station is also for one month in the year the warmest locality but this time the advantage comes at the height of the growing season (August). All through the first half of the year Tahoe is cold or cool: in January, February, and March, this lake station is colder than Fordyce or even Summit, though the latter place is 800 feet higher; in early spring Tahoe becomes warmer than these two stations, being, after Bridgeport, the warmest station, but as soon as the snow-cover melts from about Summit its monthly mean temperature rises and becomes greater than that of Tahoe till August, when, as stated above, the vegetation at Tahoe is the most favorably situated as respects heat of any of the plant populations resident at this series of mountain stations. In the fall and early winter Tahoe is warmer than the high station of Tamarack and warmer than Fordyce and Bridgeport.

If the diagram be considered with regard to the relative climate of Summit, it will be noted that at the beginning of the year and in the fall and early winter Summit is the warmest station; for seven months in the twelve its mean temperature is the highest and, in the most favorable part of the year for growth, Summit is next to the most favorable place. Its spring temperature clearly shows the chilling effect produced by melting; in March when the snow-cover attains its maximum thickness (table 5) and before melting begins, Summit is relatively warm but, with diminution in the snowfall combined with the higher mean temperature of April and the resulting thawing, Summit becomes, next to the high mountain station at Tamarack, the coldest locality. As the spring advances and the accumulated snow becomes less, the mean temperature rises and causes Summit to become relatively warmer than the other stations till by the end of summer it is the warmest of the series, a position of advantage maintained for the rest of the year.

The highest station whose climate is to be considered is Tamarack. Its altitude prevents Tamarack from ever becoming warm for very long; unlike the other stations, at no time in the year is its climate the warmest of the series. At the beginning of the year, the coldest station except Bridgeport, it becomes the coldest in April as a result of the relative rise of Bridgeport and remains the station with the lowest mean temperature till August, when it becomes warmer than Fordyce and in late fall and early winter (October-November), warmer than both Fordyce and Bridgeport, but it closes the year the next coldest station.

The local climates so far considered have but one major variable, temperature. At all four stations, Tahoe, Fordyce, Summit, and Tamarack, the total precipitation is abundant though varying within rather wide limits. This large annual rainfall (or snowfall) with accompanying cloudiness reacts upon temperature, reducing the extremes. When, however, we study the local climate of Bridgeport, the always deficient and irregular rainfall is attended by the greatest temperature ranges, both daily and monthly, found within the series. When the rainfall (snowfall) at Bridgeport sharply declines by the end of February, the thin snow-cover is entirely melted in March and relatively high temperature immediately follows in this mountain valley of the eastern slope (to a less degree, the same thing occurs in the valley of the Truckee at Tahoe, also on the east slope). Bridgeport during the next four months (April-July) is the warmest station but it will be observed by study of the temperature data throughout this period when its mean is the highest, low temperatures are constantly recorded (6 to 20 degrees of frost). The vegetation at Bridgeport and on the east slope generally must adjust itself to two sets of extremes: temperature and precipitation. It is this necessity for a twofold accommodation which explains the poverty of the east slope flora at an elevation which, on the more favored western side, supports a plant population both floristically and ecologically more highly diversified.

We have so far mainly considered the mean temperatures of this series of stations, but localized plant populations are believed to be more directly influenced by temperature extremes; at least it has been known for a long time that the several functions of the single plant have different temperature ranges and that a station may be subject to such a temperature range that a given species may be excluded, or, if admitted, one or more of its functions impeded or prevented. Unfortunately, within our region little has yet been done to exactly determine the effects upon the plants of the temperature extremes known to occur but a study of the possible temperatures at a given station with a definite plant population may be suggestive. In this connection it should be remembered that temperature ranges have very unequal effects upon plant life accordingly as they include or exclude the freezing point. While many boreal plants at the height of the growing season can withstand freezing and thawing, other kinds are not so tolerant and may not survive such change.

Considering that part of the year within which the mean monthly temperature is above freezing, we see that it is of unequal length:

Tahoe, March to November inclusive.
Fordyce, April to November inclusive.
Bridgeport, April to November inclusive.
Summit, April to November inclusive.
Tamarack, April to October inclusive.

But the vegetative season is more limited, especially for low shrubs and herbs; in spring, limited by the disappearance of the snow-cover; in fall, by the general fall in temperature combined with the scant water supply that, as a rule, then exists in the Sierra. With regard to the disappearance of the snow-cover, the data show that at Tahoe, in two years of the quadrennium, the ground was already bare by the end of May and in the other two years (1915, 1917) seven inches and one inch lay on the ground; by the first week in June "spring" is well advanced at Tahoe and vegetation has resumed active growth. In this same period (1914–17), the end of May found on the average 12.75 and 10.25 inches of snow on the ground at Fordyce and Summit, respectively; a month later the ground is practically bare.[41] At Tamarack also the end of June finds the winter's snow about to disappear and active growth initiated. It appears that the station at Tahoe, near the upper edge of the Transition life-zone, enjoys a vegetative period approximately a month longer and that this extension comes when the conditions for plant growth are best: abundant moisture and most daylight. In the higher mountains, the brevity of the period of growth is, in part, made up by the higher temperature which prevails when growth is resumed—in June, the mean temperature of Tahoe is 50.6°; in July, at Tamarack the mean temperature is 55.5°—resulting in an acceleration of the life processes in the higher mountains. It is this acceleration which causes the boreal vegetation to pass from a dormant condition to the state of active growth so rapidly, changing the aspect of the high mountain region with abruptness often astonishing to the visitor. Just as it is necessary to bear in mind that the climate of the Sierra is a composite, made up of many local varieties of the general climate of the range, so upon smaller areas defined by topographic details, the resident plant populations are subject to more or less peculiar very local climates determined by inequalities of slope and exposure, the distribution of the plant communities being correspondingly diversified.

The end of the vegetative season in autumn is less easy to define since not only at that time of the year is temperature falling but, in the Sierra, the water available to plants is less, due to several causes —seasonal distribution of the rainfall, drainage from the slopes, and lowered soil temperature with increasing difficulty of root absorption (physiological dryness).[48] Little has yet been done to satisfactorily determine when the vegetative season may be considered to close; the appearance of the snow-cover marks the appearance of winter but before this, the vigor of plant life, as interpreted by growth, has lessened. At present the most satisfactory date to regard as closing the vegetative season is in October for, just as the spring resumption of growth in the higher mountains follows a large increase in the monthly mean temperature (Tahoe, May, 42.6°, June, 50.6°; Tamarack, May, 36.4°, June, 46°, July, 57.2°), so in the autumn, the marked fall in temperature in October to November (Tahoe, 45.0°–36.5°; Tamarack, 43.6°–34.8°) indicates the time of change from active metabolism to the nearly static plant life of winter. In this connection it is interesting to note the concentration of effective temperatures at the higher stations; at Tahoe, considering the vegetative season to last from June to October and that the effective temperatures may be gauged by the sum of the monthly mean temperatures with sufficient accuracy for comparison, we find that July and August have 44.3 per cent of the total heat, but that in the shorter season of the upper Canadian life-zone, as represented by the climate of Tamarack, in the same two months is concentrated 55.3 per cent of the total.

Within the vegetative season the temperature extremes vary considerably; at all stations and in all months frost occurs. Tahoe, in the period 1914-17, was subject to minima in July of 35, 30, 31, and 35 degrees, and in August of 33, 37, 30 and 35 degrees. Fordyce, though the next coldest station in July and the coldest in August, has minimum temperatures little lower than Tahoe: in the quadrennium the low for July and August were 38, 34, 28 and 32, and 35, 38, 28 and 32 respectively. The data show that the higher stations Summit and Tamarack had in these warmest months of the vegetative season during these four years, minimum temperatures as follows: Summit, July, 35, 27, 34, 41; August, 30, 29, 33, 33; Tamarack, July, 32 (1915 not given), 37, 34; August, 32, 30, 40, 36. The east slope station of Bridgeport in the same two months had lows of 35, 27, 34, 41, and 30, 29, 33, 33. Maximum temperatures vary through wider limits than minimum temperatures; at Tahoe, the maximum recorded in the four years, 92°, occurred on July 11, 1917; the day after the same temperature was recorded at Fordyce and 86° at Summit, these temperatures not being exceeded at these places again in the quadrennium. The same date (July 11) was the year's warmest day at Bridgeport with 85°. Bridgeport attains to higher maxima earlier in the year than the other stations: in May, day temperatures of 82, 80, 74 and 60 are recorded and in the same month lows of 26, 18, 16 and 18. The highest station of the series, Tamarack, has its highest recorded temperature on October 5, 1915, 92°, with a low of 22° a week later.

The data presented in the temperature table concerning the climate of Tamarack show that the local climate of high altitude valleys in the Sierra conforms to the rule:[46] the diurnal range of temperature at Tamarack is higher than that of any other station except Bridgeport, whose exceptional climate has been referred to. The average daily range at Tamarack for the year is 51.8°, which is 19.6 per cent greater than the daily range at Fordyce and 38 per cent greater than the range at Summit.

In the general discussion of the rainfall of the Sierra, attention was directed to the great contrast which exists between the two flanks of the range. This contrast is seen within the mountains and because of it the east side of the major crest-lines receives less rainfall than the west slopes; Tahoe, though less than twenty-five miles from Fordyce, receives less than one-half as much rain. Bridgeport receives less than one-fourth as much as Tahoe and only about one-tenth as much as Fordyce, though the altitude of all three stations is similar and of Fordyce and Bridgeport equal. The seasonal distribution of rainfall has been referred to and the variation seen in the distribution on the eastern slope where a larger proportion of the scant total falls in the summer months; at Bridgeport 26.5 per cent of the total mean annual rainfall for the years 1914–17 fell in the six months from May to October inclusive; at Fordyce in the similar half-year 14.7 per cent. Though the summer months have a greater percentage of the total rainfall on the east slope, yet the west slope receives even in summer a larger amount; in the six months from May to October Fordyce received, in the years 1914–17, on the average 9.77 inches and Bridgeport 1.95 inches. This inequality with respect to summer rain is seen within the range; the east slope of the Great Western Divide, west of Lake Tahoe, receives at the station of Tahoe 2.76 inches; Fordyce, on the west slope of the same divide, has the amount mentioned above. Generally then the west slopes of the mountain divides receive more rain than the eastern slopes since the storm winds come prevailingly from the west; it is a common experience in the higher mountains to find shelter from driving rain by descending some steep eastern slope. As regards soil moisture, however, the west slopes are, as a rule, less favored in the higher mountains, partly because they are the insolated slopes in the warmer part of the day and also because the winter winds sweep the snow over the ridges and cause the deepest drifts to form on the east and northeast facing slopes, where they persist longest in the summer and yield moisture to the ground below.

TABLE 1.—MONTHLY TEMPERATURES, F. (MEANS AND EXTREMES) OF TRANSITION STATIONS IN THE NORTHERN AND SOUTHERN SIERRA NEVADA.

————————Summerdale, Mariposa County, 5,270 feet.
- - - - - - - - - - -LaPorte, Plumas County, 5,000 feet.

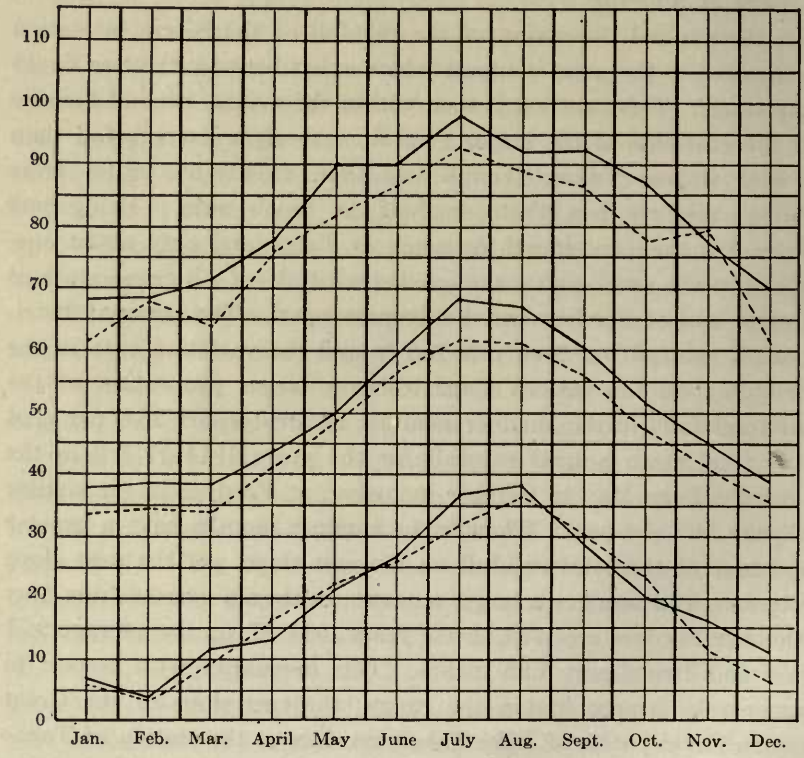


TABLE 2.—MONTHLY TEMPERATURES, F. (MEANS AND EXTREMES) OF TRANSITION STATIONS ON THE EASTERN AND WESTERN SLOPES OF THE SIERRA NEVADA

———————Cisco, Placer County, 5,939 feet (west).
- - - - - - - - - - -Truckee, Nevada County, 5,818 feet (east).

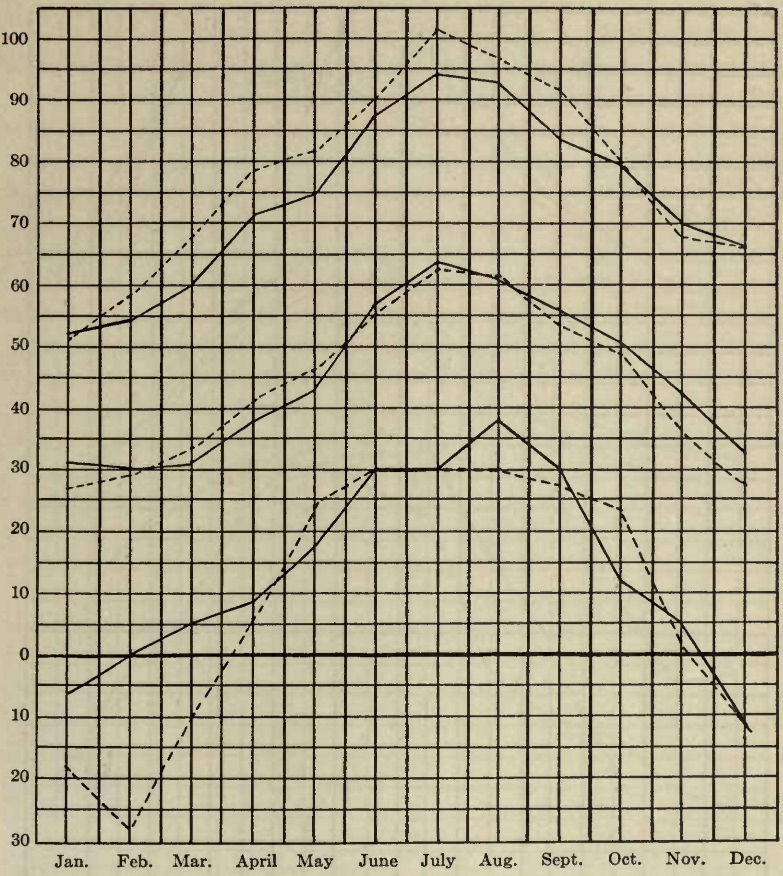


TABLE 3.—MONTHLY MEAN AND EXTREME TEMPERATURES, CANADIAN ZONE (F.).

———————— Summit, Placer County, 7,017 feet.
— — — — Tamarack, Alpine County, 8,000 feet.
- - - - - - - - - - - Bodie, Mono County, 8,248 feet.

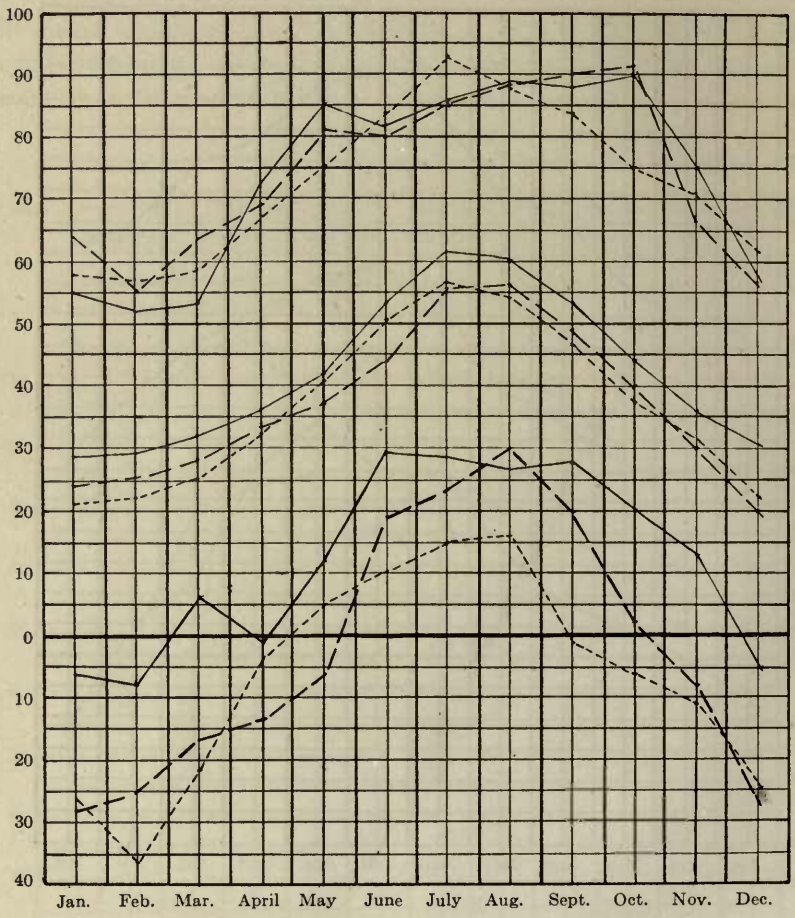


TABLE 4.—PRECIPITATION IN INCHES AT FIVE SIERRAN STATIONS, TRANSITION AND CANADIAN ZONES.

Transition:
- - - - - - - - - - -Summerdale, Mariposa County, 5,270 feet (record of 13 years).
— — — — —LaPorte, Plumas County, 5,000 feet (record of 10 years).

Canadian:
____________Summit, Placer County, 7,017 feet (record of 41 years).
—o—o—o— Tamarack, Alpine County, 8,000 feet (record of 12 years).
—v—v—v—Bodie, Mono County, 8,248 feet (record of 9 years).

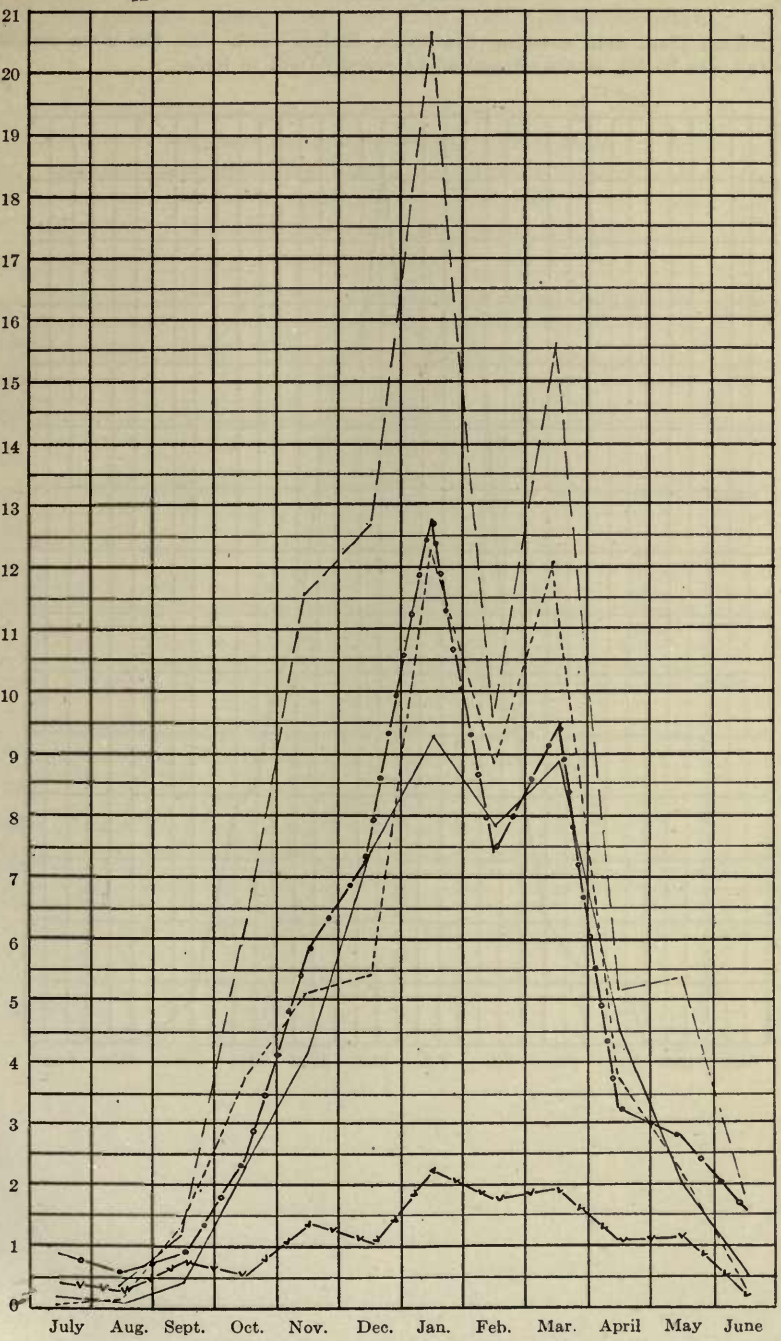


Table 5.—Depth of Snow at the Canadian Station of Summit, Placer County, 7017 Feet.

(Derived from data covering five years, during which time the mean annual snow-fall was 90.3% of the normal of 44 years. Data in inches.)

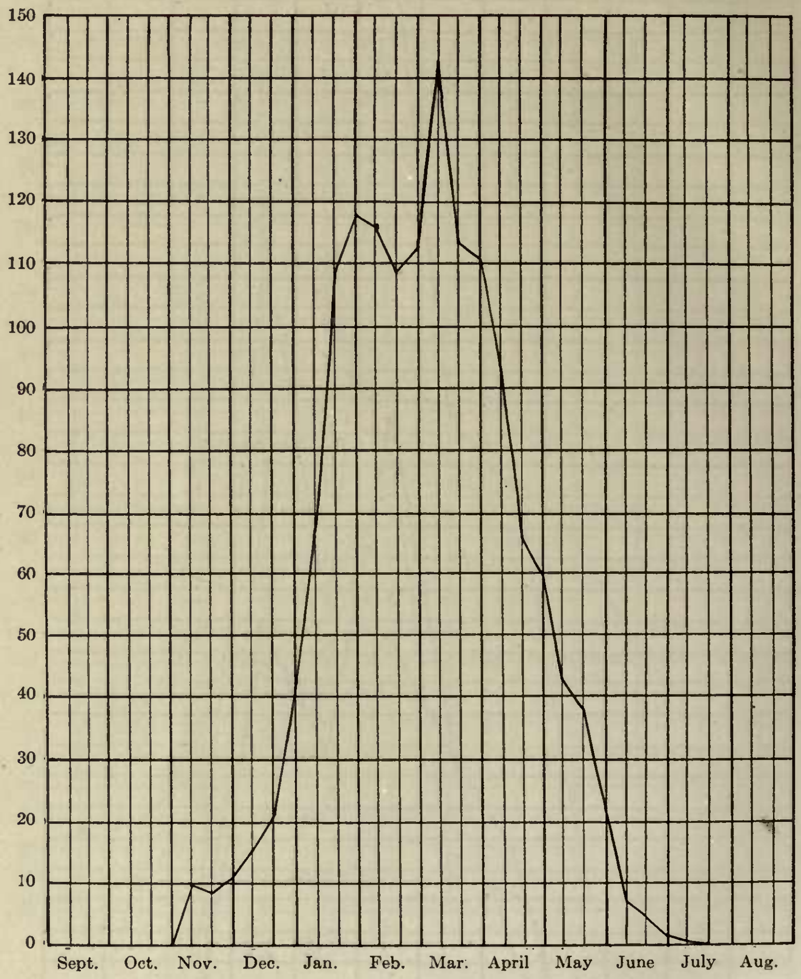


TABLE 6.—MONTHLY SNOWFALL AT SIERRA NEVADA STATIONS.

(Data in inches.)

—v—v—v—LaPorte, Plumas County, 5,000 feet.
- - - - - - - - - - -Summerdale, Mariposa County, 5,270 feet.
____________Summit, Placer County, 7,017 feet.
— — — — Tamarack, Alpine County, 8,000 feet.
—o—o—o— Bodie, Mono County, 8,248 feet.

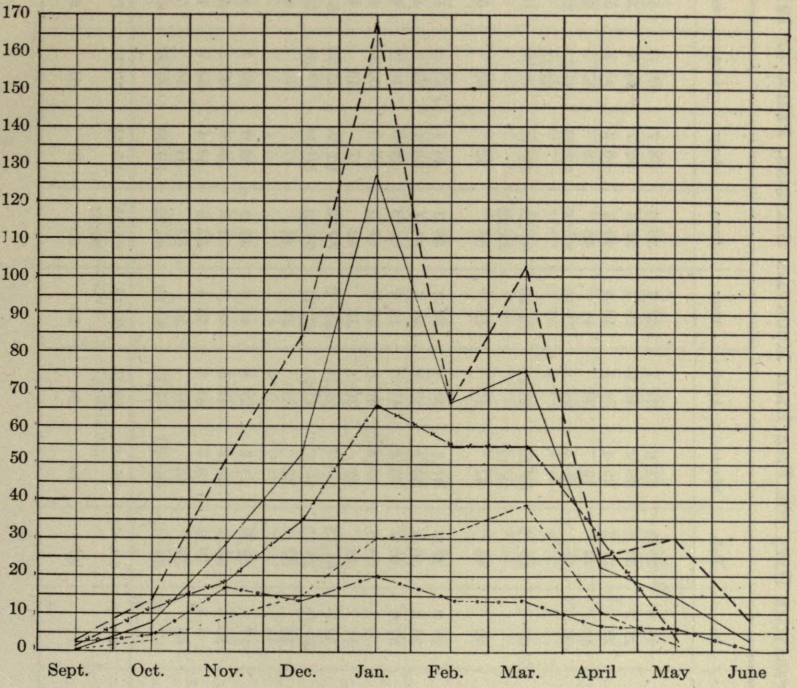


TABLE 7.—TEMPERATURE DATA FOR FIVE HIGH MOUNTAIN STATIONS, PERIOD OF 1914–17, INCLUSIVE.

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Mean
TAHOE													
Monthly mean	24.8	29.5	32.6	37.7	42.6	50.6	58.7	60.0	52.2	45.0	36.5	28.5	41.4
Greatest	27.8	34.6	35.4	40.0	46.2	52.4	62.7	62.4	54.1	48.6	38.5	34.4	....
Least	22.4	27.2	25.4	34.2	40.6	49.2	56.2	55.2	51.2	40.3	34.0	24.6	....
Range: Greatest daily	46	44	43	34	41	48	48	47	44	46	40	38	41.5
Greatest monthly	46:-15	52:- 2	64: 6	59: 9	71:15	87:26	92:35	87:33 89:35	83:28	76:22	65: 2	82:-3	....
Least monthly	46: 3	45: 2	57:10 58:11	60:21	61:20	81:25 78:22	79:35	81:30	76:25	65:22	64:22	53:19	....
Mean monthly	52	48	52	46	48	58	52	53	52	50	55	53	51.6
FORDYCE													
Mean 23 years	28.0	27.3	31.1	35.3	39.2	46.3	54.1	53.0	46.0	40.0	32.6	25.6	42.7
Monthly mean	26.3	30.4	33.1	37.2	38.5	48.4	56.1	54.0	48.5	42.0	34.2	26.4	39.6
Greatest	37.0	40.7	45.8	43.6	42.6	49.8	59.0	56.6	49.2	46.8	39.6	31.7	....
Least	20.1	24.8	23.8	30.8	36.0	47.0	54.0	50.6	48.0	35.9	30.0	22.3	....
Range: Greatest daily	41	45	39	39	38	42	47	45	43	43	45	31	43.3
Greatest monthly	52:7	61:15	58: 7	60:16	53: 2	79:23	92:38	85:35	90:30	72:22	70: 8	41: 0	....
Least monthly	30:15	38:15	44:15	52:21	50:21	64:34	80:38	77:38	65:35	52:25	40:10	38: 6	....
Mean monthly	36	37	38	41	38	44	47	46	44	40	41	35	40.6
BRIDGEPORT													
Monthly mean	17.6	21.8	25.7	39.8	44.6	52.9	59.0	58.2	50.9	42.1	33.0	24.6	39.2
Greatest	26.4	23.6	30.2	42.6	49.7	53.8	59.6	60.5	52.1	44.5	38.2	33.0	....
Least	5.8	19.2	18.7	34.1	40.4	52.2	58.4	55.7	49.9	38.2	26.8	17.6	....
Range: Greatest daily	68	59	45	46	50	52	54	54	58	59	57	46	54.0
Greatest monthly	42:-36 45:-33	50:-19	48:-20	67:12	80:18	85:22	89:26	90:27	85:19	78: 5	65:-18	50:-25	....
Least monthly	49:-8	45:-14	48:-6	68:16	60:18	84:25 82:23	85:34	90:31	79:17	73:13	65:16	52:25	....
Mean monthly	72	67	59	54	55	60	57	61	64	66	67	53	61.3

TABLE 7.—(*Continued*).

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Mean
SUMMIT													
Mean 45 years	28.0	28.8	31.4	35.5	42.6	53.2	61.0	60.3	53.7	44.0	35.8	30.5	42.1
Monthly mean	26.5	31.6	33.3	37.0	42.2	52.4	58.3	58.3	52.5	46.0	36.8	30.2	42.3
Greatest	27.8	35.8	35.0	38.4	47.7	56.6	64.4	60.6	54.1	52.1	42.5	37.2	....
Least	22.5	29.2	32.0	35.4	38.2	49.0	55.6	53.0	51.3	40.8	30.8	23.8	....
Range: Greatest daily	31	28	22	28	35	38	40	47	48	46	45	42	37.5
Greatest monthly	44: 2 37:-5	60:16	48:15	58:15	65:10	78:20	82:27	84:30	84:23	80:18	66:10 58: 2 70:14	50:-2	....
Least monthly	44: 8	40:12	49:18 48:17	53:21 52:20	55:26	75:34	80:35 86:41	82:29 86:33	74:29	71:23	64: 9	40: 4	....
Mean monthly	40	39	31	37	42	48	48	52	51	55	56	45	45.3
TAMARACK													
Mean 12 years	24.3	26.0	29.4	33.0	36.3	44.6	55.5	57.2	48.6	41.0	31.8	21.6	41.5
Monthly mean	22.1	27.5	28.6	32.8	36.4	46.0	57.2	58.2	49.7	43.6	34.8	25.9	38.5
Greatest	28.6	31.8	33.7	36.1	40.7	49.2	60.6	59.8	52.6	52.0	36.8	34.8	....
Least	17.8	23.4	23.4	28.6	32.1	43.4	54.6	56.6	42.2	36.8	31.9	13.6	....
Range: Greatest daily	58	56	60	50	52	52	46	42	58	54	47	47	51.8
Greatest monthly	48:-16 42:-22	58:-6	62:-14	59:-5	70: 8	80:22	81:32	88:30	90:12	92:22	70: 4	42:-22	....
Least monthly	42:-16	50: 2	56:14	48: 5	57:20	67:30	82:37	77:40	68:22	68:26	62:15	56:12	....
Mean monthly	62	55	63	51	48	49	47	48	58	53	57	55	50.5

LIFE-ZONES OF THE SIERRA NEVADA

Though it is not proposed in this paper to consider the different aspects or types of vegetation present in the high mountain region, it seems desirable to define the several life-zones to which plants are assigned in the following annotated list.*

LIFE-ZONES PRESENT IN THE SIERRA NEVADA

Perhaps no single phase of his problem is more perplexing to the student of plant distribution than that of attempting to delimit accurately the life-zones of the region the flora of which he would describe and compare with the floras of other regions that have contributed elements to and received immigrants from his own. No single student possesses the minute knowledge of the whole field roughly designated the Cordilleran section of North America, which would make him competent to survey this immense extent of territory. Even within much narrower limits, when attempt is made to particularize and precisely define zonal boundaries, the investigator is compelled to rely in no small part upon the results achieved by workers outside his own field of observation. By very general agreement among western students of both animal and plant distribution, the basis for current work starts with the system of life-zones formulated some twenty-five years ago by Merriam[49] and corrected in the subsequent period by its author and his co-workers on the Biological Survey.

The fundamental postulate of Merriam's system of life-zones is the assumption that for each species there exists certain fixed temperature limits, which inhibit the spread of the species into other regions where those temperature summations do not obtain. In the Cordilleran section, with its diversified topography and profound differences of altitude and therefore of climate, the limits of the life-zones are subject to many controlling factors whose importance and significance must be understood before assignment of particular plants to definite life-zones may be undertaken. The data underlying the scheme of life-zones are still inadequate and their interpretation disputed; it may well be that conclusions deduced from present evidence will, when the bases for deduction have broadened, become profoundly modified if not abandoned. Nevertheless it now seems improbable that the system of life-zones, elaborated by the investigations of so many zoo- and phytogeographers, will be actually displaced even if in the future other factors than those of temperature will be accorded greater weight.

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* The ecologic types present in the higher Sierra were investigated and the results in part published in a preliminary paper on the Tahoe region, which may be regarded as a typical cross-section of the range, and to that paper reference is here made concerning the general features of the high mountain vegetation.[39]

In California there exist all the life-zones defined by Merriam except the Tropical. The life-zones present vary greatly in extent: the Lower Sonoran life-zone embracing the deserts of the southeast, a small section of the southern coast, and the middle of the Great Valley of California; the Upper Sonoran including most of the South Coast Ranges, the inner slopes of the North Coast Ranges, and the lower slopes of the Sierra on both its flanks; the Transition extending southward from a nearly state-wide belt at the north, along the seaward slopes of the Coast Range as far south as San Luis Obispo County and along the Sierra on both its flanks nearly to the Tehachapi Mountains, with some outlying areas in the mountains of the southern part of the state. In Plumas County this Transition flora is deeply invaded by narrow east-west tongues of the Upper Sonoran flora and in places becomes almost intersected, as at Beckwith Pass, where the flora of the Great Basin sends a deep embayment into the northern Sierra Nevada. The upper limit of the Transition life-zone marks a real boundary; below it are found most of the plants generally recognized as peculiarly Californian; above it there is a constant increase in the proportion of northern and widely ranging genera and species.

The region, the plant population of which is here considered, lies on both flanks of the range above a line of varying altitude, rising to the south and higher on the eastern flank. This line, which marks the boundary between the rich temperate forest of the Transition life-zone and the more varied, if less magnificent, vegetation of the higher mountains, rises on the west flank from an elevation of about 6,000 feet in Plumas County to near 9,000 feet at the southern end of the range; in the central Sierra (from the Blue Cañon-Cisco line south to Madera County) the boundary of the boreal region conforms roughly to the 7,000-foot contour line. On the eastern slope of the chain, the line rises from 6,500 feet west of Honey Lake to 9,500 feet west of Owens Valley. Above this boundary, where the general aspect changes sufficiently to cause common recognition, lie the ''high mountains'' or ''high Sierra'' of Californian geography, a region full of interest to the visitor whatever his primary motive for journeying into it may be. To the geologist, the high mountain country offers a vast tract wherein all the forces of dynamical geology have operated upon a complex of diversely derived rocks to produce every conceivable modification of topographic detail; to the zoologist, the ''high Sierra'' is inviting because it is one of the few areas yet remaining in the west where animals are really wild and not ''protected'' to tameness; to the botanist its appeal lies not merely in the study of the individual plants, but also in the investigation and attempted solution of the problems presented by their distribution.

It is generally agreed that the presence of certain plants and animals shall be taken as indicating the existence in any particular place of a certain life-zone, these plants being styled ''zone indicators.'' Coville[50] has pointed out how unsatisfactory herbaceous plants are in this respect and particularly annuals (i.e., species of Gayophytum, Gilia, etc.), which occur throughout the series of zones, blooming in the lower mountains in spring and found in flower till the end of August or early September at higher and higher altitudes; such plants cannot be disregarded in a complete survey of the vegetation of the higher mountain region but their presence indicates that the scheme of life-zones is at best an inadequate expression of the life conditions, which, for annuals at least, change with the advancing season. As a result of their great altitudinal range, we find in the meadows and forests of the higher mountains plants which have their zones of greatest frequency hundreds or thousands of feet nearer sea level. This is in fact the criterion by which to judge the zonal position of a plant: in what zone is it most frequently seen, or where can it be most reasonably expected? When this measure of pertinence is kept in mind, zone indicators serve a useful purpose and give to the expressions ''Canadian flora of the Sierra'' or ''Arctic-alpine flora of the Cascades'' meanings readily understood by students of western plants. With this understanding of the term, it is believed that the plants named in the following lists best serve in the higher Sierra Nevada as zone indicators. Plants queried are included in the lists provisionally.

ZONE INDICATORS FOR THE CANADIAN LIFE-ZONE

Pellaea Bridgesii
Pinus monticola
Pinus Murrayana
Pinus flexilis
Pinus ponderosa var. Jeffreyi
Abies magnifica
Trisetum Brandegei
Poa Bolanderi
Bromus Suksdorfii
Eriophorum gracile var. caurinum
Carex nervina
Carex athrostachya
Luzula parviflora
Juncus nevadensis
Brodiaea gracilis
Allium platycaule
Allium validum
Quercus vaccinifolia
Eriogonum Lobbii
Eriogonum marifolium
Polygonum minimum
Polygonum alpinum
Stellaria umbellata
Lewisia triphylla
Trautvetteria grandis
Delphinium glaucum
Aconitum columbianum
Dicentra formosa
Draba stenoloba
Arabis Drummondii
Sedum obtusatum
Bolandra californica
Saxifraga Mertensiana
Spiraea densiflora?
Ivesia unguiculata
Trifolium Bolanderi
Lupinus sellulus
Oenothera xylocarpa
Epilobium brevistylum
Angelica lineariloba
Peucedanum Torreyi
Ledum glandulosum
Vaccinium occidentale
Dodecatheon alpinum?
Gentiana holopetala
Polemonium pulcherrimum (typica)
Phacelia racemosa
Phacelia hydrophylloides
Lappula nervosa?
Pentstemon azureus
Veronica humifusa
Veronica alpina var. unalaschensis
Mimulus moniliformis
Pedicularis racemosa
Castilleja Culbertsonii
Lonicera involucrata var. flavescens
Lonicera conjugialis
Aster Andersonii (typica)
Erigeron Coulteri
Erigeron miser
Senecio scorzonella
Antennaria corymbosa
Phalacroseris Bolanderi
Agoseris aurantiaca
Hieracium gracile var. detonsum

ZONE INDICATORS FOR THE HUDSONIAN LIFE-ZONE

Pellaea Breweri
Pinus albicaulis
Pinus Balfouriana
Tsuga Mertensiana
Calamagrostis purpurascens
Poa gracillima
Scirpus criniger
Carex nigricans
Carex Goodenovii
Carex luzulaefolia
Carex filifolia var. erostrata
Anemone Drummondii
Arabis Lyallii
Arabis platysperma
Ribes lasianthum
Ribes montigenum
Kalmia polifolia var. microphylla
Astragalus Bolanderi
Phyllodoce Breweri
Cassiope Mertensiana
Haplopappus suffruticosus
Arnica mollis var. scaberrima
Chaenactis Douglasii var. alpina
Artemisia norvegica
Helenium Hoopesii

ZONE INDICATORS FOR THE ARCTIC-ALPINE LIFE-ZONE

Athyrium alpestre
Agropyron Scribnerii
Trisetum Congdoni?
Poa Pringlei var. Hanseni
Festuca ovina var. brachyphylla
Carex Breweri
Carex nova
Luzula spicata var. nova
Juncus Parryi
Salix tenera
Eriogonum Kingii
Oxyria digyna
Polygonum shastense
Silene Watsonii
Aquilegia pubescens
Ranunculus oxynotus?
Draba oligosperma
Draba glacialis
Draba Lemmonii
Draba Breweri
Arabis Lemmonii
Sedum integrifolium
Ivesia lycopodioides
Ivesia pygmaea
Ivesia Muirii
Lupinus danaus
Astragalus tegetarius
Epilobium anagallidifolium
Podistera nevadensis
Primula suffrutescens
Phlox caespitosa var. muscoides
Polemonium eximium
Polemonium pulcherrimum var. parvifolium
Pentstemon Menziesii var. Davidsonii
Hulsea algida
Erigeron nevadensis?
Erigeron ursinus
Erigeron compositus var. trifidus
Raillardella argentea
Antennaria media?
Crepis nana*

ZONAL LIMITS IN THE SIERRA NEVADA

The scheme of life-zones depends upon effective temperatures during the vegetative season and the rule holds that temperature decreases with altitude. Hence in mountainous regions like the Sierra, having some elevations rising to or above snow-line, the sequence of zones will be in general altitudinal, the arctic-alpine zone including the summit region. But it by no means follows that, at a given altitude in the Sierra on the same cross-section, one may find the same life-zone. The data presented in the section on the climatology of the Sierra and especially that portion dealing with the local climates of five representative high mountain stations, show that two stations (Fordyce and Bridgeport) may have the same altitude yet their geographic position gives to the one a climate quite unlike that of the other. Fordyce has a distinctly boreal flora, the genera and species identical with or allied to high mountain or northern types; Bridgeport's flora, on the other hand, is allied to the flora of the Great Basin and to the desert flora of southern California. Again, the data show that two stations (Fordyce and Summit) may have nearly similar floras and so be assigned to the same life-zone, yet one (Summit) be referred to the warmer division of that zone (Jeffrey Pine division), while the vegetation of the other (Fordyce) be dominated by plants able to thrive with slightly lower temperature; and this in spite of the fact that the station with the microthermic plants (*Abies magnifica, Pinus Murrayana* and associated species) is actually some 500 feet nearer sea level than the place having less tolerant vegetation. These facts of distribution indicate that life-zones are not to be thought of as continuous belts of vegetation reached everywhere at successive levels within the mountains. Life-zones are rather to be considered as areas of greater or less extent with definite plant populations, which are able to grow where we find them because the local climate admits the species present and may exclude others. We are here considering only climate and therefore, for the present, no mention is made of other factors which also play a part in the distribution of plants. In mountainous regions, like the northern Sierra Nevada, where the general elevation is moderate, not all the boreal life-zones will be represented, or, if present, they will be distributed irregularly and in conformity with topography. The factors controlling the limits of life-zones have recently been listed by Hall and Grinnell.[51] A consideration of the effects of these factors will explain some of the peculiarities of the local climates of the five stations studied in the preceding section.

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* Hall and Grinnell[51] have recently published lists of zone indicators for all life-zones and including the entire state. Through the courtesy of Dr. Hall I was enabled to compare their lists for the boreal zones with my own before the publication of their paper. There are some differences in the two lists but it has seemed best to publish the lists given here as originally prepared for the Sierra Nevada only and let field comparison determine what correction should be made. It should be said, too, that Hall and Grinnell's lists are prepared from a somewhat different viewpoint than that adopted in this report. In their paper, plants have been chosen as zone indicators which are believed to occur outside the assigned zone very rarely or not at all, while in the lists appearing above frequency (dominance) has been taken as the basis for zonal assignment.

The effect of exposure, i.e., the location of a place with reference to that sector of the environment from which the major effect of the climatic factor under consideration (wind, storm track, sunlight) bears upon the place, has long been known. On open plains, a place can scarcely be said to have exposure since the climatic factors exert their effect from all quarters with nearly equal intensity. In mountainous regions, exposure becomes of fundamental importance. Since exposure is conditioned by topography, the bolder the relief, the greater will be the effect of exposure (or its reciprocal "protection"). A given station may be positively exposed to one factor and negatively related to another: a southwest slope in the northern hemisphere receives a maximum insolation (in mountains this may not be quite true because of afternoon cloudiness) and is the warmer and drier in so far as maximum insolation can control the local temperature and soil moisture;[52] on the other hand, such a slope might be protected from the effect of the prevailing wind if it blew from the northeast. In the Sierra a further complication follows from the relation of the position of the range across the storm tracks. In the Sierra, the southwest slope is the best insolated but also receives the full effect of the prevailing winds, including storm winds which accompany precipitation. Topography reacts upon climate to promote air movements; an important consequence is the settling of cold air into valleys; this so-called ''air-drainage'' operates to cause valleys to show lower temperatures than the surrounding ridges. Summit throughout the year is warmer than Fordyce, owing, in part, to the fact that the cold air drains down the valley of Fordyce Creek from the flanks of Mt. Lola and Castle Peak, while from the higher station the cold air drains away. This has been recognized as a condition modifying vegetative limits.[46, 53]

Inspection of the temperature table shows that Summit has an average daily range of temperature less than that of any other station; this small daily range is in accordance with the law of Woeikoff:[54] ''die Luft über einer konvexen Oberfläche wärmer ist in der Nacht und im Winter und kälter am Tage und im Sommer, dass also die jährliche wie die tägliche Amplitude kleiner ist, als über einer konkaven Oberfläche.'' From this law we see that vegetation growing in montane valleys has an advantage in the matter of receiving new immigrants over a plant population growing on a ridge of equal elevation; the range of temperature is greater in the valleys and the sum total of temperature is larger in valleys than on crest-lines, permitting stenothermic plants, with temperature controls near the limits, to gain a foothold in the valleys when they would be excluded from the ridges. Brockmann-Jerosch[55] has called attention to the importance of possible extremes of temperature in permitting the spread of plants: ''Der Temperaturverlauf und nicht eine Durchschnittstemperatur bedingt, soweit Wärme in Betracht kommt, die klimatische Grenze einer Art.''

Attention has been called to the fact that the high mountain region of the Sierra is a lake region with bodies of water of all sizes from a large lake like Tahoe, many square miles in area, to mere pools. The influence of these bodies of water in modifying zonal limits is recognized by the plant collector, who commonly finds near their shores species which have their zones of greatest frequency at higher levels than the actual elevation of the place of collection. This influence of small bodies of water on local climates has been considered by Bartlett[56] and Abbe.[57] Bartlett's conclusions were deduced from observations made about Madison, Wisconsin, and perhaps have no other significance for our subject than to give evidence that even small lakes exert an appreciable control. Abbe's studies on mountain lakes led him to think that they caused an amelioration of temperature about them, especially when the adjacent slopes are at such an angle as to catch the reflection from the water surface, and he was also of the opinion that evaporation tends to produce fogs which may prevent or minimize frost damage. My own observations about the high mountain lakes of the Sierra tend to a different conclusion, for the facts of plant distribution about their borders seem to indicate that the influence of the lakes is always toward a lowering of the temperature of the surrounding terrane and this inference from the results of plant collecting appears to be made more probable by a comparison of the data available concerning the climate of Tahoe and Summit. If we compare the mean summer temperature of Tahoe with that of Summit, we find that the two places have practically the same amount of heat (Tahoe, mean monthly temperature, May-October, 51.4°; Summit, 51.6°, data of 1914–17); though Tahoe is 800 feet less in altitude than Summit, its summer temperature is no higher than that of the more elevated station. According to Woeikoff's law, Tahoe, as a high mountain valley station, should have warmer summers than a ridge station such as Summit, yet we find the temperature of summer the same. The only reason for this depression at Tahoe, which is apparent, is the lake. Evaporation from a water surface must produce a cooling effect; unfortunately no data are at hand to gauge how far the smaller high mountain lakes may affect their local climates, but for Tahoe we possess some information. Measurements made at Tahoe indicate that evaporation from the lake surface may reach several inches in the summer months: June, 3.80; July, 4.0; August, 6.5; September, 4.12; October, 2.65.[58] It appears extremely doubtful that the high mountain lakes can ever modify the local climate by raising the temperature, as lakes in lowlands are known to do, since the water of the boreal lakes is always cold. There never accumulates a reserve of heat in the water of these lakes such as lowland lakes acquire in the course of a summer.

A certain effect upon zonal limits is exerted by topography in the protection afforded by bold relief to snow banks and snowdrifts against melting in summer till the season is well advanced, with consequent local cooling of air and soil in their neighborhood. In the Sierra this effect is much less significant than in mountains having perennial snow fields of large extent, such as the Cascades or the Rockies of British Columbia. Such residual drifts in the Sierra do, however, cause a characteristic assemblage of plants to grow about their margins comparable to the ''Schneefleckflora'' of European plant geographers.[59]

Summarizing what has been stated with regard to the factors modifying zonal limits, we note:

(1) That life-zones are not to be considered as vegetative belts bounded above and below by planes passed through the range.

(2) That zone boundaries are extremely sinuous or even disrupted and are determined by topography.

(3) That at the same altitude on opposite flanks unlike zones will be found in the lower mountains, the degree of unlikeness diminishing as approach is made to the summit region

(4) That within small areas in the higher mountains the vegetation will show, on the average, greater commingling of distinct forms in the valleys, with purer types of plant communities upon the ridges and summits.

(5) That the temperature difference existing between localities with distinct assemblages of plants are often so small that the only conclusion possible, if temperature difference be admitted as the controlling factor, is that plants are subject to temperature control within much narrower limits than ordinarily supposed.

The lower boundary of the Canadian life-zone has been stated to conform in the central Sierra approximately to the 6,500-foot contour for the west slope, descending at the north end of the range and higher in the mountains of Tulare County; also that it is uniformly higher on the east slope of the range, where subject to the influence of the desert, than on the seaward flank. At the north end of the range in Plumas County on the western crest (Bucks Mountain to Sierra Buttes), the elevation of the line separating the Transition and the Canadian zones may not exceed 6,000 feet and in places may become depressed by as much as 300 to 400 feet below that altitude. The boundary rises to the southward attaining an average altitude of approximately 6,300 feet in the country about Sierra Buttes. On the middle and eastern north Sierran ridges, the line is higher, owing to the diminished rainfall; east of Mohawk Valley only the highest summits, such as Grizzly Peak, Penman Peak, Mt. Jackson, show Canadian elements.[60] Eastward of Sierra Buttes in Lincoln Valley (about 6,800 feet) the Canadian forest is well developed, the Murray Pines being of large size.[61] To the south of the Sierra-Nevada County line, as the general altitude of the country rises, the Canadian life-zone becomes of greater extent and forms a continuous belt on both sides of the main divide with extensions westward to Snow Mountain and to the numerous high peaks and ridges in the vicinity of English Mountain. In this section the line separating the Transition and Canadian floras runs at about the elevation of the surface of Lake Tahoe (6,225 feet), Jeffrey Pine being the dominant tree at the south end of the lake and on the Nevada side. The variation in this district in the elevation of the Transition-Canadian boundary amounts to some 300 feet. In the Yosemite district, nearly all the country lying above the valley rim is Canadian; the line marking the lower boundary of the boreal region, north of the valley, running at about 6,700 feet on Snow Creek Trail above Mirror Lake and slightly higher on the Eagle Peak Trail. On the eastern flank, above Mono Lake, the same break occurs at approximately 7,500 feet or about 1,000 feet above the lake itself. South of the Yosemite district, the dividing line rises to 7,000 feet in Madera and Fresno counties and, in the extreme south of the high Sierra, about Mineral King, one meets the typical high mountain flora at nearly 8,000 feet, while to the east along the Sierran main crest, the Transition flora maintains itself at elevations of 9,000 or 9,500 feet on western slopes.* On the eastern flank in Mono County, the boreal region extends down the flank to about the level of Lake Sebrina (9,170 feet) where Yellow and Murray pines grow together[62] and on the west side of Owens Valley, opposite Lone Pine, to the 10,000-foot contour.[63] The upper limit of the zone, which corresponds to the lower boundary of the Hudsonian, similarly rises from an altitude of about 6,500 feet in the mountains of northern Plumas County and to 7,500 feet in the region of the Sierra Buttes. West of Lake Tahoe, the Canadian-Hudsonian boundary varies between 8,000 and 8,500 feet in altitude; east of the Lake, in the Carson Range, the upper limit of the Canadian is higher, on Mt. Rose[64] at about 9,000 feet. This last elevation is in agreement with the average altitude of the upper limit of the Canadian in the Yosemite district, though here in places Hudsonian elements are found at lower elevation, as at Snow Flat on the Tioga Road (8,700 feet). In the mountains of Tulare County, the Canadian rises to elevations of 9,500 to 10,000 feet. The area between these altitudinal limits comprises the greater part of all the high mountain country, within which certain peaks and ridges north of Sonora Pass and a fairly continuous area to the southward rise into the higher zones. But this Canadian area is itself not uniform, at least two subzonal divisions being easily recognized: the Jeffrey Pine belt and the true Canadian flora above.

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* For many details concerning plant distribution in the Sierra of eastern Tulare County, a region not yet visited by me, I am indebted to the excellent field notes made by the late Professor W. R. Dudley, of Stanford University, who made a number of collecting trips into the region from 1895 to 1904, and also to Dr. H. M. Hall, whose collecting trips have covered all the region considered in this report.

The Jeffrey Pine belt, which, besides the tree designating this division, includes the bulk of the *Abies magnifica* forest, constitutes an intermediate phase between the Transition flora and that of the true Canadian. Many of the plants often seen in the Transition are also present here and not a few of the species, common in the true Canadian, send stragglers down into this lowest section of the high mountain flora. There are, however, a number of plants which are distinctive of this lower Canadian belt:

Habenaria sparsiflora
Habenaria unalaschcensis
Populus trichocarpa
Eriogonum spergulinum
Prunus emarginata
Ceanothus cordulatus
Ceanothus velutinus
Oenothera xylocarpa (only southern Sierra)
Selinum capitellatum
Sarcodes sanguinea
Gilia aggregata (typica)
Apocynum androsamaefolium var. pumilum
Pedicularis semibarbata
Hemizonella minima var. parvula
Chrysopsis Breweri
Orochaenactis thysanocarpa (only southern Sierra)

The Jeffrey Pine belt is dominated by the forest type of vegetation; therein being allied to Transition flora; with the true Canadian begins that recession of the forest and increasing importance of the meadow characteristic of high mountain floras.

The Hudsonian zone to the north of Mariposa County is found only on the upper slopes of the peaks and ridges and nowhere in the northern portion of the range forms connected areas of considerable size. At the north end of the range, the Hudsonian is present only on the very summits of the high peaks of western Plumas County (Spanish Peak, Bucks Mountain, Mt. Pleasant[60]) and is not again found till the region of Long Lake is reached near the Plumas-Sierra county line. From the Gold Lake region southward, the islets of the Hudsonian flora occur more frequently and begin to spread out along the summits of the ridges between the peaks of the main Sierran divide, rising some five miles west of Lake Tahoe. Southwest of the lake, this zone is found on Mt. Tallac, Angora Peak, and to the west on Lucile Crest, Ralston Peak, and at various points on the intervening ridges. East of Lake Tahoe in the Carson Range, only Mt. Rose and Freels Peak rise above the Canadian zone. Southward of the Tahoe region, the general altitude quickly rises and the highest of the boreal forest zones spreads out over the high country but is still intersected by tongues of the Canadian flora through the valleys. At Sonora Pass, near the common point of Alpine, Mono and Tuolumne counties, the northern limit of the high southern Sierra is reached, and from there on to the southward the Hudsonian life-zone is practically continuous except where intersected by the Canadian flora at Tioga Pass and, more widely, at Mammoth Pass. The zone is developed on all the high summits and ridges to the west of the main divide in the Yosemite district, appearing on Mt. Hoffman and perhaps on the very summit of Clouds Rest and spreading on all the flanks of the crests that center about Mt. Lyell. South of the gap at Mammoth Pass, this zone is continuous to beyond Cirque Peak and reappears on Mt. Olancha in a narrow band at above 10,000 feet. Hudsonian plants are also found to the westward on Kaiser Crest in Fresno County and on most of the higher ridges between that divide and the high mountains west of Kern River as far south as Sheep Mountain, the southern termination of the Great Western Divide in Tulare County. Though the lower limit of the Hudsonian is difficult of definition since subject to conditions of slope exposure, the upper limit of this zone should be, at least in theory, easy of determination since the accepted boundary is at that altitude where the forest finally succumbs to the alpine climate. Practically, the exclusion of tree growth depends upon so many factors, climatic, edaphic, perhaps also biologic, that its delimitation is by no means an easy matter.

In the mountains of western North America timber line is still a purely natural phenomenon; artificial deforestation, which renders its accurate determination so difficult in Europe has not affected it, and its gradual rise from north to south attests the gradual increase with lower latitudes in the sum of effective temperatures during the season of growth. It appears that at the northern end of the Rockies, in the Athabasca-Mackenzie region, timber line is found at about 2,000 feet;[65] farther south in the mountains about the head of Stewart River, the forest yields to the alpine meadow at between 3,700–4,700 feet;[66] on the west side of the Rockies, in about the same latitude, in the Atlin District of British Columbia, timber line runs at 3,700–4,200;[67] in southern British Columbia, the better watered Selkirks have a forest cover to approximately 6,000 feet[68] or a little higher, while the drier Rocky Mountains to the east are forested about 1,000 feet higher, tree-line appearing at 7–8,000 feet.[69] The Purcell Range, near the international boundary, has the forest limited at 7,200 feet.[70] Along the coast in southeastern Alaska, the alpine meadows begin much lower down, at approximately 3,500 feet in the Sitka region.[71] The mountains of British Columbia lie at the vertex of the great angle formed by the south-trending mountains along the Pacific coast of the United States and the southeastward extension of the Rockies. The difference between the ranges of British Columbia in respect to elevation of tree-line is maintained in the mountains of the western United States. In Washington, Piper reports[72] tree-line at 6–7,000 feet; in the corresponding latitude in Montana, Rydberg[73] considers 71–8,100 feet the upper limit of the forest; this estimate for the height of timber-line in Montana differs considerably from the figures given by Gannett,[74] who found the upper forest limit in the mountains about Bozeman to be about 9,500 feet, with a line at 8,800 feet in the Absaroka Mountains, and in the Flathead district, 9,000 feet as the beginning of the alpine zone. Corroboration for Piper's estimate for Washington is afforded by Tansley's survey of Mt. Rainier, where the actual tree-line was found to be 6,800 feet.[75] Russell[76] states that timber line on the high mountains of central Idaho is near 10,000 feet. In the Cascades of Oregon, Leiberg[77] reports Mts. Thielson, Pitt, and Scott to have true timber lines at 93–9,400 feet. On Mt. Shasta, timber line is said by Merriam[63] to average considerably under 95–9,800 feet, which is the elevation of the line on the southwest slopes. In nearly the same latitude, the Uintas of Utah have an alpine zone above a timber line at about 11,000 feet and eastward in Wyoming and Colorado, the same boundary between the alps and the highest of the forest zones rises from 9,900 feet in the Yellowstone Park to 10,000 feet in the Wind River Mountains,[74] 10,500 feet in the Big Horn Mountains, and 11,100 feet in the Rockies of northern Colorado (Longs Peak). The climatic tree-line on Lassen Peak (10,437 feet) in northeastern California, is especially hard to define owing to the excessively rocky nature of the slopes, which afford a soil suitable for tree growth in only a few places; the line is approximately near the 9,200-foot contour. In the Coast Ranges of California no peaks rise above timber line. In the Sierra north of Lake Tahoe no summits rise to timber line except Mt. Rose, which is said by Heller[78] to have a true alpine summit above the 10,000-foot contour. To the west of Lake Tahoe, Pyramid Peak and Dick's Peak have treeless summits with an ill-defined tree-line at about 9,900 feet. The summits of Castle Peak and Mt. Tallac are devoid of trees because of lack of soil and force of the wind. In the high mountains to the southward of the Tahoe district as far as Mt. Olancha in Tulare County, many of the summits are truly alpine; in the Yosemite district, the line marking the forest limit runs at approximately 10,200 feet on Ragged Peak; 10,300 feet on Mt. Dana; 10,700 feet on Mt. Lyell; 10,400 feet in Farewell Gap; 10,700 feet on Mt. Kaweah; 10,600 feet on Sawtooth Peak; and 11,000 feet on Mt. Olancha; south of the last no Californian summits rise into the alpine zone except Mt. San Bernardino (11,485 feet) and possibly Mt. San Jacinto (10,805 feet).[79] The Southern Rockies of Colorado and New Mexico have approximately the same latitude as the Sierra Nevada; tree-line in Colorado rises from about 11,000 feet on Longs Peak to 11,500 feet on Pikes Peak[80] and 12,000 feet on the mountains in the southwestern part of the state.[81] In New Mexico, Truchas Peak has a tree-line at about 13,000 feet,[82] the highest elevation for timber line known from the United States. Mt. San Francisco, in northern Arizona, has a timber line to which Mearns assigns an altitude of 11,468 feet.[83]*

The data presented above at considerable length are of interest in attempting to arrive at some conclusion with regard to the migration and colonization of mountain ranges by arctic or circumboreal plants. The gradual rise of timber line and therefore the rise of the minimum altitude at which the typical arctic-alpine flora finds life conditions most favorable for occupation, is seen to be essentially similar in both the Rocky Mountains and the Cascade-Sierra system, though the actual altitudes differ by approximately 1,000 feet at the same latitude. This difference is owing to two reasons at least: greater aridity of the Rockies coupled with their continental type of climate causes the extremes of temperature to be greater than in the coast mountains; the Rockies are colder in winter and warmer in summer, but nowhere does the degree of winter cold exclude the forest; its limit is rather determined by the sum of the effective temperatures during the growth period and this sum is greater in the Rockies than in the western mountains at the same altitude. In other words, the elevation, where the total of effective heat received is insufficient for tree growth, is as much higher in the Rockies than in the parallel Pacific system as the difference between their tree-lines. The other reason believed to explain in part the higher timber-line of the Rockies is the fact that in the Cordillera the mass of land raised to equal elevations is far greater than in the Cascade-Sierra system; the latter is a long but relatively narrow mountain axis, while the Cordillera is rather an enormous plateau from which the several mountain chains rise to yet greater heights. It is well known that isotherms rise over plateaus. These reasons then seem competent to explain the increased height of tree-line along the same parallels in western North America.

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* South of the mountains of northern Arizona and New Mexico, no peaks in North America rise to above timber line till the great volcanoes in central Mexico are reached, about sixteen degrees of latitude further south, yet their tree-line is scarcely a thousand feet higher.[84]

The data presented above take no account of the difference between timber-line and tree-line, the latter referring to the elevation above which no trees are found, the former denoting the limit of the forest. Between these two limits is the area in which the forest and meadow formations are in unstable equilibrium, other factors than those termed climatic determining the issue as to which formation shall occupy a given terrane. In the Sierra it is very difficult indeed to distinguish the forest line from the tree-line, due to the fact that so much of the high mountain country is at present incapable of supporting the forest, not because trees are excluded by climatic factors, but because of the absence of soil, which again is a consequence of the extreme recency of Sierran glaciation. (See plate 4, Desolation Valley.)

One result of this brevity of post-glacial time is that over much of the boreal region within and above the Hudsonian zone, soil is nearly non-existent and the forest is now absent where perhaps it at one time existed and where it may reappear. R. S. Marshall, in his survey of the Mt. Lyell region, found nearly one half of the area of the quadrangle to be above timber line, devoid of timber, grass, or soil.[85]

A further consequence of the recency of glaciation has been to exclude from the Sierra, till soil shall form again, the alpine meadows, which are so characteristic of the mountains of Washington and British Columbia and of the Rockies of Colorado. The ''alps'' with their brilliant flowers and dense turf of grasses, sedges, and rushes, which lend so much of charm to the other high mountain regions of the west, are present in the Sierra in pocket-edition size, being represented by small patches among the *roches moutennées* or among the boulders strewn over the rock-fields. Only rarely are good-sized meadows seen in the higher mountains.*

Though the precise location of timber-line in a given place may be a matter of difficulty and involve a consideration of many factors, some of them at present too obscure for satisfactory review, yet ultimately the last vestige of arborescent growth has been passed (compare plates 1 and 2) and the alpine region definitely entered which finds its superior limit at snow-line, where such a line exists, as in the Cascades. But in the Sierra the existence of snow-line is only to be inferred from the presence of vestigial glaciers at certain points in the Yosemite district and in the mountains to the southward. There is no place in the Sierra today where snowfall exceeds melting. There are therefore no "eternal snows" in the Sierra and no restriction upon the area open to occupation by suitable plants because of the existence of a niveal region.

But this alpine region is by no means a continuous area; rather it is everywhere broken up and only found on isolated summits in the Sierran region adjacent to and southward of Lake Tahoe. At the present day there is no truly alpine habitat between Lassen Peak and Mt. Rose. In the Tahoe region, the summits of Pyramid Peak, Dicks Peak, Freels Peak, and possibly the summit of Mt. Tallac are of alpine character. South of the Tahoe district, islets of arctic-alpine plants become increasingly numerous and in the high mountains above the Yosemite Valley the total area occupied or open to colonization by arctic-alpines becomes considerable, and the same is true for the southern Sierra. This fragmental character of the arctic-alpine terrane unquestionably reacts upon the flora in preventing the spread of its component species; many of them must be dependent upon more or less fortuitous agencies for their dispersal. Yet the alpine region of the Sierra in its present state offers certain possibilities for plant invasion by appropriate types perhaps superior to those of the majority of the western high mountain ranges. The very recency of its glaciation has removed much of the competition to which an immigrant plant is, as a rule, subjected and to which it usually succumbs; the high gradient of the alpine region generally promotes landslips whereby a former plant population is removed and free ground exposed for colonization. The sporadic distribution of many of the distinctive alpine plants lends some support to the view that they are in fact passively transported from station to station, but by what agency is at present obscure. In spite, however, of the fact that the Sierra would seem to offer as suitable a habitat for the arctic-alpine flora, or for the "Glazialpflanzen" of Engler[86] as the Cascades or the Rockies, we find its flora, as exhibited in the following list, to be singular among the boreal floras of the west in its paucity of high arctic types. Of the plants found at high altitudes in the Rockies and in the mountains of Washington and British Columbia and ranging north to the Arctic, a significant number have failed to reach the Sierra, though not a few have entered the mountains of northern California.

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* J. N. LeConte writes of a camping place in the alpine region south of Yosemite: "This was one of those rare spots in the Sierra above the timber-line where the grass covers the hills and valleys, like the Coast Range in spring." Bull. Sierra Club, vol. 7, pp. 1–22. 1909.

STATISTICAL ABSTRACT FROM THE ANNOTATED LIST

FLORISTIC COMPOSITION OF THE BOREAL FLORA OF THE SIERRA NEVADA

That part of the high mountain flora of the Sierra Nevada composed of vascular plants, is made up of 57 families divided into 243 genera and 633 species.* Five of the families belong to the pteridophytes. The spermatophyte families include the single gymnosperm family of Pinaceae, leaving the flowering-plants to be divided among 51 families. None of the plant families are peculiar to the region covered by this report.

The 5 families of pteridophytes include 14 genera; the Polypodiaceae with 10 genera and the other 4 families with 1 genus each. Although the Polypodiaceae include the majority of the species (13 out of a total of 20), the genus-species ratio is less in this family than in any other pteridophyte family except Selaginellaceae, where the single genus *Selaginella* is monotypic. A notable fact connected with the pteridophyte element in the Sierran high mountain flora is the exclusion of the genus *Lycopodium,* which has 5 boreal species in Washington,[72] one of which (*L. annotinum* L.) ranges southward in the Rockies to Colorado in the same latitude as the Sierra. The Pinaceae include 4 genera: *Abies* and *Tsuga,* monotypic; *Juniperus* with 2 species, and *Pinus* with 6 species. Here again there is a significant difference between the flora of the mountains of the Pacific Northwest and of the Rockies and of that of the higher Sierra. All of the genera and all of the species, except *Pinus Balfouriana, P. flexilis,* and *Abies magnifica,* present in our region, are also boreal elements in Washington, but of the 20 species of gymnosperms present in the northern Cascades, 10 attain their southern limit on the Cascade-Sierran axis at some point to the north of our region, though some of them continue down the Rocky Mountains to our latitude or even attain lower latitudes in New Mexico and Arizona. The characteristic northern gymnosperm genera *Picea* and *Larix* have no representatives in the Sierra Nevada though both are found in the Cascades, *Larix* coming south to Mt. Hood and northwest Montana, and *Picea* to northern California along the Cascades, and in the Rockies to New Mexico and Arizona.

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* It is freely admitted that the basis for this report is a concept of the species (and of the subordinate categories) which is frankly conservative; I have not intentionally rejected any new definition merely because of its newness but have sought to examine it carefully and determine, as best I could, its value. Many species recently proposed have seemed to me of no merit whatever, to be in fact mischievous, since their definition interferes with what, in my opinion, is the natural relationship. Most of the species here admitted as components of the high mountain flora of the Sierra were defined in a period when the concept of the species was more comprehensive than that held by many botanists of today, and it is probably true that many of the species recognized in the *Annotated List* will seem to some too inclusive, just as many of the varieties and forms included will appear to have good claims to be considered as deserving of higher taxonomic rank. It is believed, however, that this attitude strengthens, rather than weakens, any conclusions which now may be drawn with regard to floristic relationships. Certainly if one were seeking to establish the thesis that the flora of every mountain range of the west is a thing apart, he could find abundant verbal justification in the numerous descriptions of local races or even of individual abnormalities which have been issued as specific diagnoses. It is hoped that the judgments concerning these matters expressed in the *List* will not be found wanting in a significant number of cases.

Of the 51 families of Angiosperms, the largest, both in number of genera and species, is *Compositae.* This great family, of world-wide distribution, has within our limits 32 genera and 91 species. Of its genera *Erigeron* is the largest, having 12 species in the Canadian life-zone or above, followed by *Senecio* with 9 species, *Aster* and *Arnica* each with 7, and *Artemisia* with 6. All the other genera of Compositae, resident in the higher Sierra, have 5 or fewer species (*Haplopappus* 5; *Chrysothamnus, Antennaria, Hieracium,* each 4; *Hulsea,* 3; *Helenium, Eriophyllum, Chaenactis, Raillardella, Achillea, Cirsium, Agoseris,* and *Crepis,* each 2; the remaining 14 genera, or nearly one-half of the total, are monotypic).

The family having the next largest number of *genera* is *Gramineae,* with 18 genera, *Poa* and *Agrostis,* each with 5 species, being the two largest. The remaining 28 species of grasses in the high mountains include 4 in *Calamagrostis,* and 3 each in *Trisetum* and *Agropyron;* the other genera have 2 or 1 each, there being 8 monotypic genera, or again nearly one-half of the total number of genera of grasses.

After Compositae, the family with the largest number of *species* is *Cyperaceae,* the 4 genera of which are divided into 52 species, the vast majority being in *Carex* (44 species), the largest genus of the boreal flora.

Of the 5 largest boreal plant families of the Sierra, counting number of species, *Scrophulariaceae* has the largest genus-species ratio with 41 species divided among 8 genera, or slightly more than 5 species per genus. *Mimulus* (13 species) is the largest genus with *Pentstemon* (9 species) and *Castilleja* (8 species) next in order, the other 5 genera present within our region dividing the remaining 11 species, 2 of the 5 being monotypic.

Rosaceae in its 14 genera includes the same number of species as *Gramineae,* i.e., 38. *Potentilla* is the largest genus, having 13 species; the nearly allied genus *Ivesia* takes 7 species, leaving 12 genera to include the remaining 18 species, though of this dozen genera 7 (more than half) are monotypic.

These five families—*Compositae, Cyperaceae, Scrophulariaceae, Gramineae,* and *Rosaceae*—include 66 genera and 260 species, or 28.4 per cent of the genera of Angiosperms within our limits, and 43.1 per cent of the species. The reasons for this predominance of composites, sedges, figworts, grasses, and rosaceous plants in the high mountain region are still obscure, but the character of their reproductive bodies may, in part, explain their successful occupation of the alpine and subalpine country. Excluding *Scrophulariaceae,* the typical fruit of these groups of plants is the achene, small, of light weight, and well protected against injury by the hardened ovary wall which encloses an embryo provided with stored food. The achene is the exclusive type of fruit in *Compositae, Cyperaceae,* and *Gramineae* (here slightly modified as the caryopsis or grain), while in *Rosaceae,* it is the fruit of those genera, like *Potentilla, Ivesia,* and *Horkelia,* which, if number of species be interpreted as a criterion of generic success, have been most successful. In *Scrophulariaceae* achenes are replaced by many-seeded ovaries, the seeds themselves being small and enclosing an embryo in copious albumen, the whole seed analogous to an achene from the point of view of ease of distribution and provision for germination. When one recalls the rigorous features of the high mountain habitat, the temperature extremes, the force of the wind, and the uneven nature of the terrane, the advantages which the achene or some similar type of propagule may be presumed to have seem significant.

The other 57 per cent of the boreal angiosperm flora is made up of the remaining 46 families of flowering plants having representation in our region. These families are unequally represented.

(*a*) 5 families have more than 20 species:
- (1) Cruciferae, 11 genera, 26 species.
- (2) Polygonaceae, 4 genera, 25 species.
- (3) Saxifragaceae, 9 genera, 24 species.
- (4) Leguminosae, 4 genera, 23 species.
- (5) Liliaceae, 13 genera, 21 species.

(*b*) 9 families have from 10 to 19 species inclusive:
- (1) Ranunculaceae, 10 genera, 19 species.
- (2) Ericaceae, 12 genera, 17 species.
- (3) Umbelliferae, 12 genera, 16 species.
- (4) Caryophyllaceae, 5 genera, 14 species.
- (5) Hydrophyllaceae, 5 genera, 14 species.
- (6) Polemoniaceae, 3 genera, 13 species.
- (7) Juncaceae, 2 genera, 13 species.
- (8) Salicaceae, 2 genera, 11 species.
- (9) Onagraceae, 4 genera, 11 species.

(*c*) 6 families have from 5 to 9 species inclusive:
- (1) Borraginaceae, 5 genera, 9 species.
- (2) Gentianaceae, 4 genera, 9 species.
- (3) Portulacaceae, 4 genera, 8 species.
- (4) Caprifoliaceae, 3 genera, 7 species.
- (5) Primulaceae, 3 genera, 5 species.
- (6) Orchidaceae, 3 genera, 5 species.

(*d*) The remaining 26 families have 4 or fewer species, those starred being represented by a single species: *Sparganiaceae, Najadaceae, *Juncaginaceae, Iridaceae, Betulaceae, Fagaceae, Loranthaceae, *Nympheaceac, Fumariaceae, Droseraceae, Crassulaceae, *Geraniaceae, *Linaceae, *Callitrichaceae, *Aceraceae, Rhamnaceae, Malvaceae, *Hypericaceae, Violaceae, *Halorrhagidaceae, *Cornaceae, Apocynaceae, Labiatae, Rubiaceae, *Lentibulariaceae, *Valerianaceae.*

The relative importance of the several genera of angiosperms whose species make up the greater part of the vegetation of the high Sierra, is unequal. The genera with large representation are comparatively few and may be ranked as follows on the basis of the number of their species:

Carex,	44 species
Eriogonum	13 species
Potentilla	
Mimulus	
Erigeron	12 species
Lupinus	
Juncus	9 species
Salix	
Polygonum	
Pentstemon	
Senecio	
Arabis	8 species
Epilobium	
Gilia	
Castilleja	
Saxifraga	7 species
Ribes	
Ivesia	
Phacelia	
Aster	
Arnica	
Allium	6 species
Draba	
Astragalus	
Artemisia	
Agrostis	5 species
Poa	
Scirpus	
Gentiana	
Haplopappus	

These 30 genera account for 275 species, leaving 195 genera of minor importance among which to divide the 328 species of flowering plants not included within the great genera above listed. Of these 195 genera, 112 are monotypic, each having but a single species. The remaining 83 genera divide 216 species and have a genus-species ratio of 2.6. Perhaps a better idea of the significance of a comparatively few leading genera may be gained if percentages are compared. When this is done, it appears that:

13.3 per cent of the genera include 45.6 per cent of the species;
36.9 per cent of the genera include 35.8 per cent of the species;
49.7 per cent of the genera include 18.5 per cent of the species.

Summarizing the data here reviewed we find that the 633 vascular plant species of the boreal region of the Sierra are segregated into

(*a*) 5 families of pteridophytes with 14 genera and 20 species;
(*b*) 1 family of gymnosperms with 4 genera and 10 species;
(*c*) 51 families of angiosperms with 225 genera and 603 species, which are grouped in
    (1) 30 genera of major importance, each with 5 or more species and totaling 275 species;
    (2) 83 genera of minor importance with 216 species;
    (3) 112 monotypic genera.

Besides those plant groups which, in the writer's opinion, are sufficiently marked to deserve recognition as species, there are in the flora of the higher Sierra Nevada certain less well defined congeries variously called *subspecies, varieties,* and *forms,* which in the aggregate raise the total number of plant groups requiring nomenclatural differentiation to 682.

GEOGRAPHICAL ANALYSIS OF THE BOREAL FLORA OF THE SIERRA NEVADA

These 682 more or less well marked floristic units, which in the aggregate make up the plant population of the higher Sierra, have unequal ranges. Some are endemic within the Sierra; some have their presumable point of origin within our limits but are now more or less widely spread beyond its borders as emigrants; others are certainly immigrants from adjacent or more remote areas. Comparing the known ranges of these high mountain species, varieties, and forms, we find

(a) 205 with this distribution: present in the Sierra Nevada, Southern Cascades, Northern Cascades, mountains of British Columbia, Northern Rockies, Southern Rockies at least as far south as Colorado, many of them also in the mountains of New Mexico.*

(*b*) 154 peculiar to the Sierran region, as defined in this paper.

(*c*) 81 common to the Sierra, Southern Cascades, Northern Cascades, and mountains of British Columbia.

(*d*) 57 distributed as follows: present in the Sierra Nevada, ranging northward through the Cascades to the mountains of British Columbia (a few extending farther north) and present in the Northern Rockies but not reaching the Southern Rockies.

(*e*) 47 to be present in the Sierra and extending northward to Mt. Shasta and the mountains of Siskiyou County (a few of the plants included here are also found in the mountains of southern California).

(*f*) 40 inhabiting the Sierra and the Southern Cascades, also the mountains of eastern Oregon and southwest Idaho. A few plants of this group are known from the Warner Mountains of Modoc County.

(*g*) 32 with this distribution: present in the Sierra and in the Rockies, mainly the Southern Rockies, though a few here included are known to range north to Alberta. The essential fact with regard to this class is that they are not present in the Cascades and mountains of British Columbia.

(*h*) 24 growing in the Sierra, mainly on the eastern flank, and on the ranges of the Great Basin and western side of the Cordillera from southwest Montana to western Colorado.

(*i*) 24 common to the Sierra and mountains of southern California. A few plants of this group are also found on the desert ranges of southeastern California (White Mountains, Panamint Mountains).

(*j*) 18 present in the Sierra and ranging northward through the Cascades to Alaska but not known from the Rocky Mountains (plants mainly of the Alaskan coastal strip).

It appears that of the total number of kinds of plants now found in the high Sierra, 225 (*b* plus *e* plus *i*) are peculiar to the Californian region, which conforms to the political state except that it includes the outlying spurs of the Sierra Nevada, just east of Lake Tahoe, and a small area in southwest Oregon, which, geologically and, it is believed, biologically, has a closer relationship with the mountains of Siskiyou County than with the balance of the State of Oregon.

We find then nearly one-third of the boreal flora of the Sierra essentially Californian; a nearly equal fraction of the total number composed of species of very wide distribution in the Cordilleran and Pacific sections of North America; and the remainder including plants present in extra-Californian mountain floras but of less extended ranges than the plants of the second group.

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* *Southern Cascades:* Cascades of Oregon south of and not including Mt. Hood.
Northern Cascades: Mt. Hood and Cascades of Washington and British Columbia.
Northern Rockies: Rocky Mountains north of the Laramie Plains.
Southern Rockies: Rocky Mountains south of the Laramie Plains.

In western North America there are recognized, by very general agreement, at least three fairly distinct divisions: the Rocky Mountains, the Pacific Northwest (Oregon, Washington, Idaho, and British Columbia), and the Californian region. Dr. Rydberg has shown that the Rocky Mountains should not be considered as a unit floristically, but should be divided into the Northern Rockies and Southern Rockies with the subalpine plains of southern Wyoming intervening.* It is of some interest to note the relative numbers of plant forms possessed in common by the Sierra Nevada and by each of these subdivisions of the Rocky Mountains. The geographic analysis of the Sierran high mountain flora presented above indicates that of the 682 plants distinguished in this report:

261 (*a* plus *g* plus *h*†) are common to the Sierra Nevada and the Southern Rockies.

286 (*a* plus *d* plus *h*) are common to the Sierra Nevada and the Northern Rockies.

361 (*a* plus *c* plus *d* plus *j*) are common to the Sierra Nevada and the Pacific Northwest.

Expressing these similarities in familiar terms, we find that over one-half of the plants distinguished in the Sierra Nevada are also present in the Northwest; more than one-third are common to the Sierra and to the Southern Rockies; an intermediate fraction expresses the degree of similarity with respect to the Northern Rockies.

KEY TO THE FAMILIES OF THE ANNOTATED LIST

Sporophylls free or, if aggregated, never forming true flowers; plants with spores and without seeds. **PTERIDOPHYTA** (Ferns and Fern Allies)
  Leaves usually ample or, if small, never reduced to scales forming sheaths about the solid stems; sporophylls not aggregated into terminal cones (*strobili*) formed of peltate scales.
    Terrestrial plants; leaves never grass-like.
      Leaves (fronds) not closely overlapping or imbricated, of medium to large size, each with a stalk or stipe; sporangia numerous on each sporophyll.

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* *Torreya*, vol. 12, pp. 73–85.

† *h* includes a number of plants, some of which are common to the Sierra and both Northern and Southern Rockies, and some common to the Sierra and only one of these subdivisions, but at present the details of plant distribution for eastern Idaho, southwest Wyoming, and western Colorado, are too imperfectly known, at least to me, to warrant an attempt to distinguish the exact ranges of the plants included in this group. Accordingly *h* is added to both of the totals assigned to the divisions of the Rocky Mountains, a procedure not affecting the degree of similarity with the Sierran flora of these two divisions as compared to each other, though it may affect the value of comparing either of these totals with that assigned to the Pacific Northwest.

Leaf solitary but divided into a sterile and a fertile part; sporangium sessile, without an annulus. Family 2. **Ophioglossaceae**

Leaves few to many, not divided into sterile and fertile parts; sporangium stalked and having an annulus. Family 1. **Polypodiaceae**

Leaves closely imbricated, very small attached to the stem by broad bases; sporangium solitary in the leaf axils. Family 4. **Selaginellaceae**

Aquatic plants, submerged or merely emergent, with tufted grass-like leaves having enlarged bases which enclose the sporangia. Family 5. **Isoetaceae**

Leaves reduced to scales and united by their bases to form sheaths about the hollow jointed stems; sporophylls aggregated into terminal cones (*strobili*) formed of peltate scales. Family 3. **Equisetaceae**

Sporophylls aggregated into true flowers; plants producing seeds. **SPERMATOPHYTA** (Conifers and Flowering Plants)

*Plants with ovules exposed upon the sporophylls and not enclosed within an ovary; woody plants with (in ours) always evergreen needle-like or scale-like leaves. **GYMNOSPERMAE**: in our region with but a single family. Family 6. **Pinaceae**

Plants with ovules enclosed within ovaries; woody or herbaceous plants with evergreen or deciduous foliage. **ANGIOSPERMAE, or True Flowering Plants

I. Flowers composed of parts arranged in 3's or 6's, never in 4's or 5's (i.e., 3 petals, 6 stamens, etc., never 4 petals, 5 stamens, etc., except *Potamogeton* with 4-merous flowers); ours all herbaceous plants with the leaves having their prominent veins parallel: stems without central pith and ringlike layers. MONOCOTYLEDONS

Ovary or ovaries distinct (in *Juncaginaceae* united at first but separating at maturity) and simple; perianth (= sepals and petals taken together) none or calyx-like.

Perianth none, or calyx-like with scalelike divisions.

Flowers not in the axils of dry chaffy bracts.

Flowers monoecious, grouped into globose heads along the upper part of the stem, the upper heads staminate, the lower pistillate. Family 7. **Sparganiaceae**

Flowers perfect, not in globose heads.

Immersed plants with flowers composed of 4 sepals, 4 stamens, and 4 ovaries, the latter always distinct. Family 8. **Najadaceae**

Terrestrial plants with grasslike, somewhat fleshy leaves and flowers composed of 6 sepals, 6 stamens, and usually 6 ovaries, the latter at first united but distinct at maturity. Family 9. **Juncaginaceae**

Flowers in the axils of dry chaffy bracts, aggregated into spikes or spikelets.

Stems mostly terete (round) and hollow, sheathed by the bases of the leaves, the sheaths mostly open opposite the blades; anthers versatile and stigmas plumose; fruit a grain. Family 10. **Gramineae**

Stems mostly triangular and solid; leaf-sheaths closed; anthers basifixed, stigmas not plumose; fruit an achene. Family 11. **Cyperaceae**

Ovary compound (= formed of more than a single carpel); perianth always present, its segments in 2 series.

Ovary superior (i.e., free from the calyx).

Plant rush-like; perianth segments similar, chaffy, none petaloid. Family 12. **Juncaceae**

Plant not rush-like; at least the inner whorl of perianth segments petaloid. Family 13. **Liliaceae**

Ovary inferior (i.e., its wall united with the calyx).

Flowers in umbels, regular; stamens 3. Family 14. **Iridaceae**

Flowers in spikes or racemes, irregular; stamen 1. Family 15. **Orchidaceae**

II. Flowers composed of parts arranged in 4's or 5's, rarely otherwise; leaves with the veins forming a network; stems with central pith and, if perennial, showing annual rings. DICOTYLEDONS

*Corolla none: calyx absent or present: if present, then herbaceous or petaloid (in *Caryophyllaceae,* the corolla commonly present).

Trees and shrubs.

Flowers in catkins (aments).

Both staminate and pistillate flowers in catkins.

Flowers 1 to each scale or bract of the catkin, the ovary developing to a many-seeded, 1-celled pod with comose seeds. Family 16. **Salicaceae**

Flowers 2 or 3 to each scale of the catkin; ovary becoming a winged nutlet. Family 17. **Betulaceae**

Staminate flowers only in catkins; pistillate flowers in an involucre becoming an acorn cup or spiny bur. Family 18. **Fagaceae**

Flowers not in catkins.

Leaves alternate, functional; fruit an achene with persistent long plumose style. Family (30). *Cercocarpus*

Leaves opposite, scale-like; parasitic dwarf shrubs, growing on conifers (in ours). Family 19. **Loranthaceae**

Herbs, sometimes suffrutescent at base.

Ovary superior.

Calyx present.

Pistil 1, its ovary 5-celled; reddish or whitish saprophyte. Family (44). *Allotropa*

Pistil 1, its ovary 1-celled.

Stipules present and forming sheaths about the nodes. Family 20. **Polygonaceae**

Stipules absent.

Flowers involucrate; calyx 6-parted. Family (20). *Eriogonum*

Flowers not surrounded by an involucre; calyx and corolla 5-parted, or the latter wanting. Family 21. **Caryophyllaceae**

Pistils more than 1 and distinct (i.e., each an ovary), forming achenes or follicles. Family 24. **Ranunculaceae**

Calyx absent (i.e., flowers naked); aquatic plant with opposite leaves. Family 34. **Callitrichaceae**

Ovary inferior; aquatic plant with whorled leaves. Family 40. **Haloragidaceae**

**Calyx and corolla both present, the latter of distinct petals.

Calyx entirely free and separate from the pistil or pistils.

Flowers with stamens distinct.

Stamens hypogynous, more than 10.

Pistils several to many, simple and distinct, becoming achenes or follicles. Family 24. **Ranunculaceae**

Pistil 1.

Ovary 1-celled.

Leaves entire, fleshy; petals 8–16, sepals 4–8, style divided into filiform divisions. Family (22). *Lewisia*

Leaves compound, thin or membranous; petals reduced or sometimes wanting, sepals 4; style obsolete and stigma broad, obscurely lobed. Family (24). *Actaea*

Ovary more than 1-celled.

Aquatic herb with peltate leaves, petals 10–20, sepals 5–12, anthers dark red. Family 23. **Nympheaceae**

Terrestrial creeping dwarf plants; petals 5, sepals 5, stamens in 3–5 bunches, anthers yellow. Family 38. **Hypericaceae**

Stamens hypogynous, 10 or fewer.

Pistils more than 1, distinct.

Pistils more numerous than sepals or petals. Family 24. **Ranunculaceae**

Pistils as many as the sepals or petals. Family 28. **Crassulaceae**

Pistils 5, more or less united at first but separating as 1-seeded carpels when mature. Family 32. **Geraniaceae**

Pistil 1.

Ovary becoming 2-celled by a false partition; flowers cruciferous (4 sepals, 4 petals, 6 stamens—4 long, 2 short—or rarely fewer; fruit a silique or silicle). Family 26. **Cruciferae**

Ovary 1-celled; stamens equal.

Corolla irregular (= petals not uniform)

Stamens 5, connivent over the ovary; petals 5, lower petals spurred; sepals 5, unequal. Family 39. **Violaceae**

Stamens 6; petals 4; sepals 2; flowers somewhat cordate at base. Family 25. **Fumariaceae**

Corolla regular.

Leaves strictly basal with circinnate vernation, bearing viscid glandular hairs; flowers in secund racemes on leafless peduncles; insectivorous bog-plants. Family 27. **Droseraceae**

Leaves not strictly basal, usually more or less scattered on the stems; no insectivorous bog-plants.

Leaves reduced to functionless scales; white or brownish saprophyte of coniferous forest floors. Family (44). *Pleuricospora*

Leaves not reduced to scales; autotrophic plants.

Calyx of 4 or 5 distinct or united sepals. Family 21. **Caryophyllaceae**

Calyx of 2 distinct sepals. Family 22. **Portulacaceae**

Ovary more than 2-celled.

Anthers opening by terminal pores. Family 44. **Ericaceae**

Anthers opening by longitudinal slits. Family 33. **Linaceae**

Stamens perigynous.

Stamens inserted on the edge of a hypogynous disk within the calyx; ovary 2-celled, becoming a 2-winged samara. Family 35. **Aceraceae**

Stamens borne on the calyx.

Leaves simple, exstipulate; stamens 5 or 10; pistil always solitary. Family 29. **Saxifragaceae**

Leaves simple or compound, stipulate; stamens 10 to numerous; pistils 1 to several. Family 30. **Rosaceae**

Flowers with stamens united by their filaments, monadelphous or diadelphous.

Stamens 10 or fewer; flowers irregular; ovary 1-celled; leaves compound.

Stamens 6, diadelphous, in two sets of 3 each; sepals 2 and petals 4; flowers somewhat cordate at base. Family 25. **Fumariaceae**

Stamens 10, diadelphous (9 united and 1 free) or monadelphous; sepals and petals 5; flowers papilionaceous. Family 31. **Leguminosae**

Stamens numerous united by their filaments into a tube about the several-celled ovary; leaves simple. Family 37. **Malvaceae**

Calyx united with the pistil or pistils (ovary inferior).

Herbaceous plants.

Flowers not in umbels.

Flowers apetalous; stamen solitary. Family (40). *Hippuris*

Flowers with petals; stamens more than 1.

Style 1; sepals and petals 4 (rarely 5 or 2). Family 41. **Onagraceae**

Styles 2 to 5; sepals and petals always 5. Family 29. **Saxifragaceae**

Flowers in umbels (the rays of the umbel sometimes short and the flowers appearing in capitate clusters). Family 43. **Umbelliferae**

Shrubs.

Petals 5.

Fruit a pome. Family 30. **Rosaceae**

Fruit a capsule.

Stamens 10, anthers basi-fixed; petals plane or merely curving, not hooded. Family (29). *Jamesia*

Stamens 5, anthers versatile; petals hooded. Family (36). *Ceanothus*

Fruit a berry. Family (29). *Ribes*

Petals 4; fruit a drupe. Family 42. **Cornaceae**

***Calyx and corolla both present, the latter of more or less united petals.

Stamens free from the corolla; anthers opening by terminal pores (except in *Pleuricospora* the anthers dehisce by longitudinal slits to the base, and in *Allotropa* to the middle, of each cell). Family 44. **Ericaceae**

Stamens inserted on the corolla; anthers opening by longitudinal slits.

Ovary superior.

Stamens more than 5.

Petals 5, sepals 5.

Pistil 1.

Stamens 10, monadelphous or diadelphous; ovary 1-celled. Family 31. **Leguminosae**

Stamens numerous, monadelphous; ovary several-celled.
Family 37. **Malvaceae**

Pistils 4 or 5, distinct; stamens 10. Family 28. **Crassulaceae**

Petals 4, in pairs; sepals 2; stamens 6, diadelphous.
Family 25. **Fumariaceae**

Stamens 5 or fewer.

Corolla regular.

Pistil 1.

Stamens as many as the lobes of the corolla and opposite to the lobes. Family 45. **Primulaceae**

Stamens as many as or fewer than the lobes of the corolla and alternate with the lobes.

Ovary 1 or 2-celled; styles or stigmas 2 or 1.

Fruit with septicidal dehiscence; herbage smooth; style 1, entire or slightly lobed at tip; ovary 1-celled.
Family 46. **Gentianaceae**

Fruit with loculicidal dehiscence; herbage more or less hairy; styles 2, or 1 and 2-cleft; ovary 1 or 2-celled.
Family 49. **Hydrophyllaceae**

Ovary 3-celled; style 3-cleft or 3-lobed.
Family 48. **Polemoniaceae**

Ovary 4-celled and usually 4-lobed, the lobes maturing into 4 nutlets; leaves and stems harsh to the touch or densely covered with prickles.
Family 50. **Borraginaceae**

Pistils 2, becoming follicles with seeds (in ours) long comose.
Family 47. **Apocynaceae**

Corolla irregular, more or less conspicuously 2-lipped.

Ovary 4-lobed, splitting into as many nutlets; foliage aromatic.
Family 51. **Labiatae**

Ovary entire, developing into a capsule.

Ovary 1-celled; aquatic plant with finely dissected leaves.
Family 54. **Lentibulariaceae**

Ovary 2-celled; terrestrial plants. Family 52. **Scrophulariaceae**

Ovary inferior.

Stamens distinct; flowers not in involucrate heads.

Calyx persistent upon the achene-like fruit, its free limb divided into about 15 filiform divisions and forming a kind of pappus; stamens 3; herbs only. Family 56. **Valerianaceae**

Calyx not pappose; herbs and woody plants.

Leaves small, verticillate in whorls of 3 or more; stems delicate, herbaceous or slightly woody; annuals and perennials.
Family 53. **Rubiaceae**

Leaves opposite, medium to large in size; all woody plants.
Family 55. **Caprifoliaceae**

Stamens united by their anthers to form a tube about the divided style; stamens always 5; flowers in involucrate heads.
Family 57. **Compositae**

ANNOTATED LIST OF THE SPECIES OF VASCULAR PLANTS GROWING WITHIN THE BOREAL REGION OF THE SIERRA NEVADA

1. POLYPODIACEAE (Fern Family)

- Indusia present, covering the sori at least when young.
  - Sori marginal, with a *false indusium* formed by the reflexed and altered margin of the frond.
    - Stalks of the fronds light colored; fronds evidently of two sorts, sterile and fertile .... **1. Cryptogramma**
    - Stalks of the fronds dark; fronds not evidently of two sorts.
      - False indusium continuous at edge of segment; fronds small.
        - Stalks of the fronds chaffy or hirsute .... **2. Cheilanthes**
        - Stalks of the fronds naked .... **3. Pellaea**
      - False indusium not continuous; fronds large .... **4. Adiantum**
  - Sori not marginal; each sorus with its own *true indusium*.
    - Indusium peltate or laterally attached, superior and entire.
      - Sori oblong, parallel to the oblique lateral veins .... **5. Asplenium**
      - Sori orbicular or reniform.
        - Indusium centrally attached.
          - Indusium round, without a sinus .... **6. Polystichum**
          - Indusium reniform .... **7. Dryopteris**
        - Indusium laterally attached .... **8. Cystopteris**
    - Indusium inferior and fimbriate .... **9. Woodsia**
- Indusia never present .... **10. Athyrium**

1. CRYPTOGRAMMA

1. **Cryptogramma acrostichoides,** R. Br. App. Frankl. Jour., p. 767. 1823.

Type locality.—"In shady rocky woods, between lat. 56° and 60° north."

Range.—Alaska to Quebec, south to California, Colorado, and the Great Lakes.

Zone.—Hudsonian and Arctic-alpine.

Specimens examined.—Plumas County, Mrs. Austin in 1877; cliffs of granite ledges above Donner Lake, Sonne 323; high mountain near Donner Pass, Torrey 597; Long Lake, Plumas County, 6,700 feet, Hall 9,342; near Summit, Heller 7,027; Pyramid Peak, W. S. Atkinson in 1900; Lake Lucile Ridge, Tahoe, Dudley, June 26, 1900; Suzy Lake, McGregor 108; Heather Lake, 8,100 feet, Smiley 161; Tahoe region, 6–8,000 feet, G. B. Grant in 1906; Angora Lake, 7,600 feet, Smiley 12; Mt. Tallac trail, 8,000 feet, Abrams 4825; Mono Pass, 9–10,000 feet, Bolander 6241; Old Tioga Road, dry ledges, R. A. Ware 560; near Lake Tenaya, Yosemite, 8,300 feet, Smiley 699; Tioga

Road near Dark Hole, 7,700 feet, Smiley 882; Old Baldy, Fresno County, A. A. Eaton; Mineral King, Coville and Funston 1502; Mt. Silliman, Tulare County, Mrs. Brandegee in 1905.

2. CHEILANTHES

1. **Cheilanthes gracillima** D. C. Eaton, Bot. Mex. Bound. Surv., vol. 2, p. 234. 1859.

Type locality.—"Cascade Mountains of Oregon at 7,000 feet altitude, lat. 44°."

Range.—British Columbia to southern California; east to Idaho.

Zone.—Arid Transition to Hudsonian.

Specimens examined.—Butterfly Valley, Plumas County, Mrs. Austin; mountains around Webber Lake and Sierra Valley, J. G. Lemmon; crevices in granite ledges above Donner Lake, Sonne 319; Glen Alpine trail to Mt. Tallac, 9,000 feet, Abrams 4,847; Yosemite Valley, Canby, October, 1869; Kern-Kaweah Falls, Tulare County, 10,000 feet, Dudley 2374.

Christ[87] extends the range of this fern to Central Mexico and Costa Rica and eastward to Missouri. I have seen no representatives outside of the range indicated above.

Cheilanthes Fendleri Hook. is reported by Parish[88] from Mt. Stanford (now called Castle Peak), but I have seen no evidence that the species enters the high mountains of the Sierra.

3. PELLAEA

Lanceolate fronds once pinnate and all alike.
  Pinnae entire or rarely a few divided; stalk not brittle..............1. **P. Bridgesii**
  Pinnae divided into two unequal lobes; stalk very brittle...........2. **P. Breweri**
Triangular fronds thrice pinnate and of two sorts, fertile and sterile..3. **P. densa**

1. **Pellaea Bridgesii** Hook., Sp. Fil., vol. 2, p. 238. 1858.

Type locality.—"Mountains, interior of California."

Range.—Sierra Nevada.

Zone.—Canadian.

Specimens examined.—Summit Valley, 8,000 feet, Pringle, September 21, 1882; above Meadow Lake, Lemmon 1229; Bierstadt Peak, 7,300 feet, Davy 3200; above Donner Lake toward Donner Pass, Heller 7015; ridge below Lake Lucile, Dudley, June 26, 1900; Desolation Valley, Tahoe, 8,400 feet, Smiley 99; rocks above Glen Alpine road, Tahoe, Miss Lathrop, July 12, 1909; Silver Lake, 8,000 feet, Hansen 648; granite ledge above Donner Lake, Sonne 322; Mariposa

County, crevices of dry ledges at 5,400 feet, R. A. Ware 525; Glen Alpine, Setchell and Dobie, July, 1901; trail from Snow Creek to Lake Tenaya, Yosemite, 8,000 feet, Smiley 675; Mineral King, south slope at 2,750 m., Coville and Funston 1418.

2. **Pellaea Breweri** D. C. Eaton, *in* Gray, Proc. Am. Acad., vol. 6, p. 555. 1866.

Type locality.—"Rupestris inter montes *Sierra Nevada* Californiae altitudine 7,800–9,000 ped. super mare." *Brewer.*

Range.—Sierra Nevada east to Colorado and north to Oregon.

Zone.—Hudsonian.

Specimens examined.—Summit of the Sierra Nevada, Brandegee; base of Castle Peak, 9,500 feet, Pringle, September 27, 1882; east slope of the Sierra five miles west of Truckee, 8,300 feet, Sonne 320; trail to Angora Lake over moraine south of Fallen Leaf Lake, 7,300 feet, Smiley 6; Yosemite, Lemmon, August, 1872; Amador Pass, among rocks at 9,000 feet, Brewer 2102; Sonora Pass, 7,000 feet, Brewer 1919; Mono Pass, 9–10,000 feet, Bolander 6243; side of Mt. Dana, 12,000 feet, Lemmon, August, 1878.

Miss Eastwood reports[89] this fern as very common at Bullfrog Lake and East Lake in the high mountains of Tulare County.

3. **Pellaea densa** Hook., Sp. Fil., vol. 2, p. 150., pl. 125. 1852.

Onychium densum Brack., *in* Wilkes' Exped., vol. 16, p. 120. 1854.

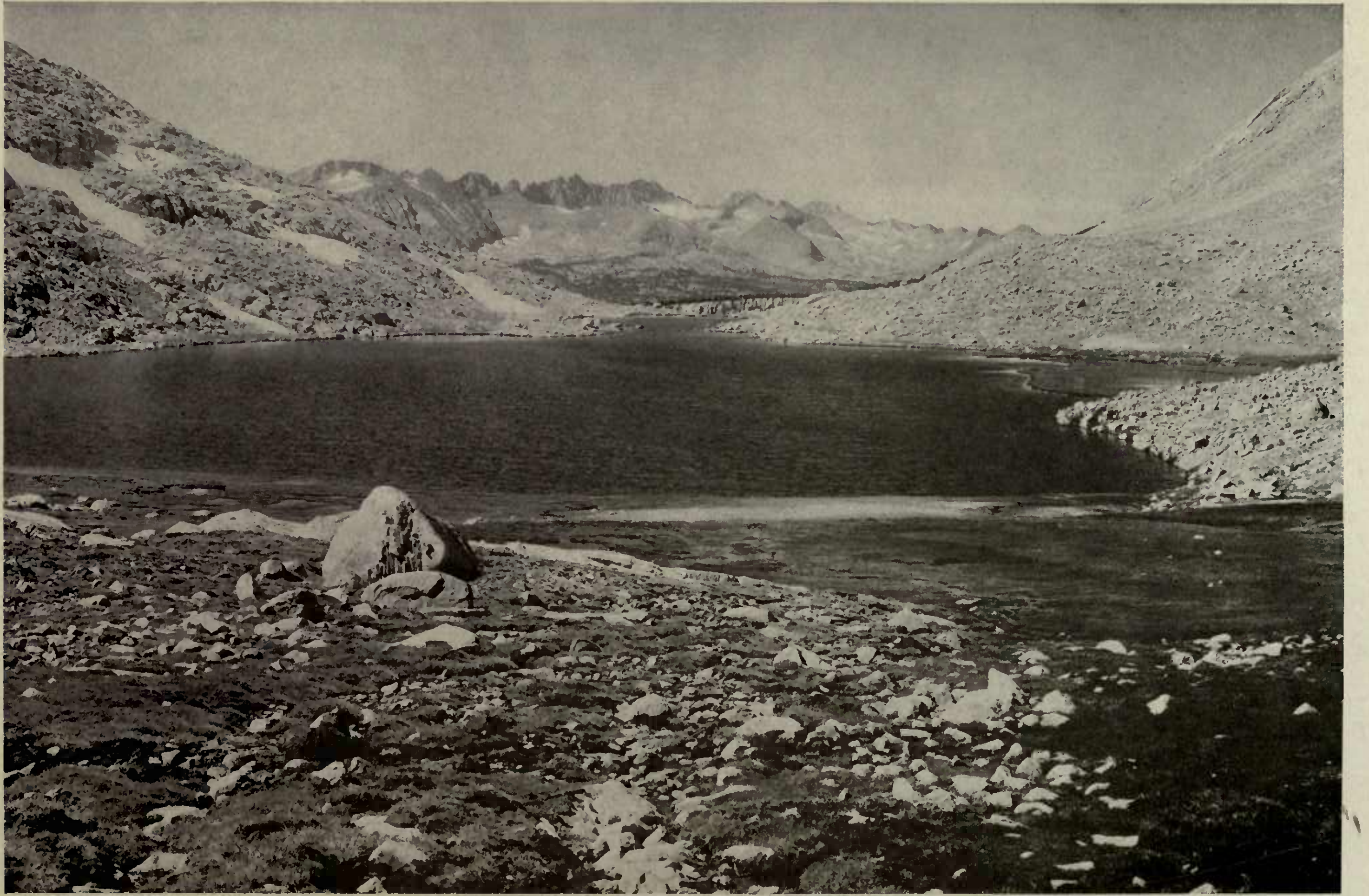
Type locality.—"Oregon, on the banks of Rogue's Rover."

Range.—British Columbia east to Montana and south to Kings River in the Sierra and in the Rockies to Wyoming; also in eastern Canada (Ontario and Gaspe).

Zone.—Upper Sonoran to Canadian.

Specimens examined.—Above Donner Lake toward Donner Pass, Heller 7168; Tahoe, G. B. Grant in 1906; among rocks near Fallen Leaf Lake, Miss Lathrop, July 12, 1909; Pyramid Peak, W. S. Atkinson in 1900; Silver Lake, 8,000 feet, Hansen 648; cliffs of granite ledges above Donner Lake, Sonne 321; Yosemite, Torrey 590; near Mineral King, Coville and Funston 1454.

Pellaea brachyptera (Moore) Baker, reported by Parish[88] to grow "at high altitudes in the Sierra Nevada," is not known to me as occurring above the Transition life-zone and is common only on dry rocks in the Upper Sonoran.



ARCTIC-ALPINE ZONE, SOUTHERN SIERRA NEVADA, TULARE COUNTY: KAWEAH PEAKS IN THE MIDDLE DISTANCE.

4. ADIANTUM

1. **Adiantum pedatum** var. **aleuticum** Ruprecht, Distrib. Crypt. Vasc. in Imp. Ross., p. 49. 1845.

Type locality.—Unalaska and Kadiak.

Range.—Alaska to California, east in the north to the Gaspe Peninsula, Quebec.

Zone.—Transition to Hudsonian.

Specimens examined.—Cliffs at Glen Alpine, 7,000 feet, McGregor 138; Yosemite Valley and mountains, Torrey 597; rocks north of Farewell Gap, Tulare County, 11,300 feet, Purpus 5674.

This variety is a rare fern in the Sierra: besides the above reported stations, it is said by Jones[90] to grow at Summit, Nevada County.

5. ASPLENIUM

1. **Asplenium filix-foemina** var. **cyclosorum** Ruprecht; D. C. Eaton *in* U. S. Geog. Surv. W. 100th Merid., vol. 6, p. 331. 1879.

Athyrium cyclosorum Ruprecht, Beitr. Pflanzenk. Russ. Reich., vol. 3, p. 41. 1845.

Type locality.—"Petropawlowski! et Unalaschka! Kadiak!"

Range.—Alaska to California and Arizona, east to Nebraska. Siberia.

Zone.—The few specimens seen of this fern do not warrant zonal assignment.

Specimens examined.—Glen Alpine, McGregor 172; ravine near Fallen Leaf Lake, Tahoe, 6,300 feet, Smiley 364.

The typical Lady Fern (*A. filix-foemina* Bernh.) is abundant in moist shady places in the Transition zone of both the Sierra and the Coast Range, but does not rise above that level.

The form noted by Miss Eastwood at East Lake and other places in the mountains of Tulare County and referred by her[89] to *Athyrium cyclosorum strictum* Gilbert (List N. M. Pterid., p. 32, 1901) has not been seen by me.

6. POLYSTICHUM

Pinnae linear-lanceolate; stipe long .... 1. **P. munitum**
Pinnae broader, triangular in outline; stipe short .... 2. **P. Lonchitis**

1. **Polystichum munitum** Presl., Tent. Pterid., p. 83. 1836.

Aspidium munitum Kaulf., Enum. Fil., p. 236. 1824.
Dryopteris munita Kuntze, Rev. Gen., vol. 2, p. 813. 1891.

Type locality.—"Habitat in California." *Chamisso.*

Range.—Alaska to California, east to Idaho.

Zone.—Transition and Canadian.

Specimens examined.—Plumas County, Mrs. Austin; Sierra Valley, Lemmon in 1873; Shuteye Mountain, Madera County, 7,000 feet, J. Murdoch 2566.

These specimens are referred to the type by the average small size of the fronds; the larger-fronded variety—var. *imbricans* (Eaton) Maxon (Fern Bull., vol. 8, p. 30. 1900)—occurs on our northern border.

2. **Polystichum Lonchitis** Roth., Tent. Fl. Germ., vol. 3, p. 71. 1800.

Polypodium Lonchitis L., Sp. Pl., p. 1088. 1753.
Dryopteris lonchitis Kuntze, Rev. Gen., vol. 2, p. 813. 1891.

Type locality.—"Habitat in alpinus Helvetiae, Baldi, Arvoniae, Monspelii, Virginiae."

Range.—Circumpolar in the northern hemisphere: south in America to California, Colorado, New York, and Gulf of St. Lawrence.

Zone.—Hudsonian and Arctic-alpine.

Specimen examined.—Long Lake, Plumas County, 6,800 feet, Mrs. C. C. Hall 9347.

Polystichum Lemmonii Underw. (Our Native Ferns, ed. 6, p. 116. 1900), a species of alpine habitat in northern California and ranging north to Alaska, has as yet not been collected in the Sierra Nevada.

7. DRYOPTERIS

1. **Dryopteris nevadense** Underw., Our Native Ferns, ed. 4, p. 113. 1893.

Aspidium nevadense D. C. Eaton, Ferns N. Am., vol. 1, p. 73, pl. 10. 1878.
Nephrodium nevadense Baker, Ann. Bot., vol. 5, p. 321. 1891.

Type locality.—"In moist meadows and along creeks in Sierra Nevada of North California, especially in meadow containing also Darlingtonia near Quincy, Plumas Co."

Range.—Sierra Nevada and north in the Cascades of Oregon.

Zone.—Transition and Canadian.

Specimens examined.—Mill Creek, Plumas County, Mrs. Austin in 1877; Lake Chiquito, Madera County, J. W. Congdon, August 16, 1895; Devil's Gulch, Mariposa County, J. W. Congdon, August, 1892.

8. CYSTOPTERIS

1. **Cystopteris fragilis** Bernh., *in* Schrad. Neues Jour. Bot., vol. 1, p. 27. 1806.

Polypodium fragilis L., Sp. Pl., p. 1091. 1753.
Filix fragilis Underw., Our Native Ferns, ed. 6, p. 119. 1900.

Type locality.—"Habitat in collibus Europae frigidioris."

Range.—In America from Newfoundland to Alaska, south to Georgia, New Mexico, and southern California. Europe. Asia.

Zone.—Transition to Arctic-alpine.

Specimens examined.—Plumas County, Mrs. Austin, August, 1882; Webber Lake, Lemmon; ridge south of Donner Pass, 8,500 feet, Heller 7179; Pyramid Peak, W. S. Atkinson in 1900; high mountain south of Donner Pass, Torrey in 1865; Lake of the Woods meadow, Tahoe, under a large boulder, 8,400 feet, Smiley 53; Angora Lake, cliffs at 7,600 feet, Smiley 10; Glen Alpine, 7,000 feet, Smiley 200; Yosemite Valley, Torrey 599; Crabtree meadows, Tulare County, 11,000 feet, Culbertson (B 4352).*

9. WOODSIA

1. **Woodsia scopulina** D. C. Eaton, Can. Nat., vol. 2, p. 90. 1865.

Type locality.—"Rocky Mountains near 40° north latitude, Parry, Hall and Harbour."

Range.—Alaska and British Columbia, east to the Great Lakes and south to California, Arizona, and Colorado. Also Gaspe Peninsula, Quebec.

Zone.—Hudsonian.

Specimens examined.—Sierra County, Lemmon in 1874; Sierra Nevada (without locality), 10,000 feet, J. Muir; rock crevices on Tamarack trail, Tahoe, 8,000 feet, Smiley 255; Mono Pass, J. Congdon, August 26, 1895.

Reported as common about Bullfrog Lake, Tulare County, 10,600 feet.[89]

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* In this list specimens cited as "Culbertson (B 4352)" refer to plants collected by Culbertson but distributed to the various larger herbaria as a part of C. F. Baker's general distribution.

10. ATHYRIUM

1. **Athyrium alpestre** (Hoppe) Rylands, *in* Moore, Ferns Gr. Br. Nat. Pr., vol. 1, t. 7. 1857.

Polypodium alpestre Hoppe, Taschenb., p. 216. 1805.

Type locality.—European.

Range.—Holarctic and alpine; in the mountains of North America south to California and Montana. Also on Gaspe Peninsula, Quebec.

Zone.—Hudsonian and Arctic-alpine.

Specimens examined.—Near Tahoe, Brandegee, August, 1884; Long Lake, Plumas County, 6,700 feet, Mrs. C. C. Hall 9341; ridge south of Donner Pass, 7,500 feet, Heller 7186; Pyramid Peak, east slope, 9,600 feet, Smiley 101; Devil's Gulch, Mariposa County, J. W. Congdon, August, 1892; Heather Lake, Tahoe, Hall, July 28, 1910; Sawtooth Peak, Tulare County, 11,500 feet, Culbertson (B 4538).

2. OPHIOGLOSSACEAE (Adder's Tongue Family)

1. BOTRYCHIUM

Plant small (2–5 inches); vernation straight .... 1. **B. simplex**
Plant large (1–2 feet); vernation inclined .... 2. **B. californicum**

1. **Botrychium simplex** var. **compositum** (Lasch) Milde, Fil. Europae et Atlantidis, p. 197. 1867.

B. Kannenbergii forma *compositum* Lasch., Bot. Ztg., vol. 14, p. 608. 1856.

Type locality.—Not given.

Range.—In North America from Nova Scotia to Alaska and south to Maryland, Minnesota, Wyoming and California. Northern Europe.

Zone.—Hudsonian meadows.

Specimens examined.—Mt. Lyell, J. Muir in 1872 (said *in* Bot. Calif., vol. 2, p. 331 to be from foot of Lyell Glacier); Cathedral Trail, Tuolumne County, J. W. Congdon, August 7, 1898; Dana Fork meadows, Yosemite, along the creek, 9,700 feet, Smiley 851; Kaweah meadows, Tulare County, 9,300 feet, purpus 5046.

Coville and Funston 1632 from Whitney meadows, Tulare County, growing in granite sand, and also their number 1704 from North Fork of the Kern River, have not been seen but are probably referable to this variety. What I suspect to be the same plant was noted by Miss Eastwood on Bubb's Creek.[89]

2. **Botrychium californicum** Underw., Torreya, vol. 5, p. 107. 1905.

B. Coulteri Underw., Bull. Torr. Bot. Club, vol. 25, p. 537. 1898.
B. ternatum var. *australe* D. C. Eaton, Ferns N. Am., vol. 1, pl. 20a, lowermost figure only.

Type locality.—"Quincy, Plumas County." Mrs. Austin.

Range.—Northern Sierra south to the Kings River region.

Zone.—Transition and Canadian.

Specimens examined.—Sierra County, Lemmon in 1874; Lily Lake, Tahoe, at water's edge, 6,600 feet, Smiley 386; Mt. Silliman, Tulare County, 9,000 feet, Mrs. Brandegee, August 24, 1905.

This plant is very close to *B. silaifolium* Presl. (Rel. Haenk., vol. 1, p. 76. 1830) and further study may show it to be only a form of that species which ranges from British Columbia to California.

3. EQUISETACEAE (Horse-tail Family)

1. EQUISETUM

Sterile stem profusely branched; annual .... 1. **E. arvense**
Sterile stem normally unbranched; perennial .... 2. **E. hyemale**

1. **Equisetum arvense** L., Sp. Pl., p. 1061. 1753.

Type locality.—"Habitat in Europae agris, pratis."

Range.—Holarctic; south in America to Virginia, Colorado, and California.

Zone.—Transition and above.

Specimens examined.—Trail to Pyramid Peak below a snow bank, 8,600, Smiley 108; Mineral King, Culbertson (B 4558).

2. **Equisetum hyemale** L., Sp. Pl., p. 1062. 1753.

Type locality.—"Habitat in Europae sylvis, asperis, uliginosis."

Range.—North temperate zone.

Zone.—Transition and Canadian.

Specimens examined.—Ravine near Fallen Leaf Lake, Tahoe, Smiley 360.

S. H. Burnham (Plant World, vol. 1, p. 10) reports finding on Eagle Peak, above Yosemite Valley, at 8,000 feet, a plant probably referable to this species.

Equisetum laevigatum A. Br. (Am. Jour. Sci., vol. 46, p. 87. 1844) grows in the Sierra along streams below our border.

4. SELAGINELLACEAE

1. SELAGINELLA

1. **Selaginella Watsoni** Underw., Bull. Tor. Bot. Club, vol. 25, p. 127. 1898.

Type locality.—Not given but the type (*Watson* 1370) was collected in the East Humboldt Mountains, Nevada, at 8,000 feet, as appears from the label.

Range.—"Apparently confined to high altitudes of the Sierra Nevada and neighboring mountains."

Zone.—Hudsonian.

Specimens examined.—Cloud's Rest, Yosemite, 9,500 feet, in granite sand, Smiley 515 (does not completely agree with the type as the leaves are stouter than in Watson's plant); above Donner Lake toward Donner Pass, Heller 7167.

Coville and Funston 2071, from 1,700 feet above timber line on Mt. Whitney, is cited in the description, as is *Hansen* from Alpine County at 8,000 feet.

5. ISOETACEAE (Quillwort Family)

1. ISOETES

Stomata present; leaves soft, long attenuate ....1. **I. Bolanderi**
Stomata absent; leaves firm, abruptly acuminate ....2. **I. pygmaea**

1. **Isoetes Bolanderi** Engelm., Am. Nat., vol. 8, p. 214. 1874.

Type locality.—"In ponds and shallow lakes on the Sierra Nevada of California, at an altitude of 5,000–10,000 feet," and "Yellowstone Lake, 7,400 feet altitude." Bolander and Parry.

Range.—California to Washington, east to Colorado and Montana.

Zone.—Canadian.

Specimens examined.—Lakes in Summit Valley, 7,500 feet, Pringle, September 22, 1882; Glacier Point Meadows, Yosemite, Smiley 492; near Whitney meadows, in ponds at 3,000 m., Coville and Funston 1643; Tuolumne meadows, in ponds back of Muir Lodge, 8,500 feet, Smiley 747.

2. **Isoetes pygmaea** Engelm., Am. Nat., vol. 8, p. 214. 1874.

I. Bolanderi Sonnei Henderson, Bull. Torr. Bot. Club, vol. 27, p. 358. 1900.

Type locality.—"In large patches in mud, covering gravel, deeply submerged in running water, on the Mono trail, eastern declivity of the Sierra Nevada, 7,000 feet alt." Bolander.

Range.—Central Sierra Nevada.

Zone.—Canadian.

Specimen examined.—Webber Lake, Lemmon, September, 1886, referred doubtfully as the velum appears to be complete.

The basis for *I. Bolanderi Sonnei* is a plant found by C. F. Sonne, October, 1887, in Donner Lake. It has not been seen but the characters relied upon to separate it are precisely those distinguishing *I. Bolanderi* and *I. pygmaea.*

6. PINACEAE (Pine Family)

- Strobili woody and dry; leaves diverging from the branches spirally.
  - Strobili pendant and falling intact, the scales persistent.
    - Leaves borne on short shoots, in ours in fascicles of two or more; strobilus of hard woody bracts .... 1. **Pinus**
    - Leaves not borne on short shoots, single, with decurrent woody bases, these persistent on the branches; bracts of strobilus thin .... 2. **Tsuga**
  - Strobili erect, their scales deciduous from the persisting axis .... 3. **Abies**
- Strobili fleshy and berry-like; leaves opposite and appressed, or in whorls and diverging .... 4. **Juniperus**

1. PINUS

- Needles with a single fibro-vascular bundle; the umbo terminal on the apophysis; needles 5 in a fascicle. *Soft Pines.*
  - Cones slender, long peduncled, 6–8 inches long .... 1. **P. monticola**
  - Cones short and thick, short peduncled or nearly sessile, 2–5 inches long.
    - Cone scales with thinner rounded ends, the umbos not forming protuberant beaked tips; cones larger .... 2. **P. flexilis**
    - Cone scales with thicker ends, the umbos beak-like; cones smaller. .... 3. **P. albicaulis**
- Needles with 2 fibro-vascular bundles; the umbo central on the apophysis; needles in 5's or less than 5. *Hard Pines.*
  - Needles in 5's; umbos of cone scales with a minute prickle or unarmed; needles ¾–1 inch long; bark smooth .... 4. **P. Balfouriana**
  - Needles in 3's; umbos of cone scales with a long prickle; needles 5–10 inches long; bark rough and thick .... 5. **P. ponderosa** var. **Jeffreyi**
  - Needles in 2's; umbos of cone scales with a short prickle; needles 1–3 inches long; bark very smooth and thin .... 6. **P. Murrayana**

1. **Pinus monticola** Don, *in* Lambert, Pinus, ed. 2, vol. 3, p. 27, t. 87. 1837.

Type locality.—Not ascertained.

Range.—British Columbia to northwest Montana, south in the Cascades through Oregon and northern California, continuing in the Sierras to the Kings River region.

Zone.—Canadian.

Specimens examined.—Sierra Valley, Lemmon; Summit Valley, Pringle, September 26, 1882; Angora Peak, Tahoe, 8,625 feet, Smiley, 37; cañon above Glen Alpine, 7,500 feet, Smiley, 357; near Glen Alpine, W. A. Setchell, July, 1901; Lambert's Dome, Tuolumne meadows, Yosemite, Dudley, July 20, 1901; Cloud's Rest, Dudley, June 13, 1894; same at 8,700 feet, Smiley 513; Mt. Raymond, 8–9,000 feet, Bolander; Bald Mountain, Dinkey Creek, Fresno County, 10,000 feet, Hall and Chandler, 372; Kaiser Crest, 9,600 feet, Smiley 647; near Mineral King, Coville and Funston, 1416; summit above Mountain Lake, Tulare County, Dudley 934.

P. monticola in the northern Sierra habitually occurs between 7,000 and 8,000 feet, with a lower limit of 6,000 on north slopes and rising in a few places to 9,000. It is often found growing with *Abies magnifica* near the upper limit of the fir, and commonly with *Pinus Murrayana*. In a few places it forms pure stands, as on the ridge between Donner and Webber lakes. In the southern Sierra, it is most abundant on the windward (west) sides of the ranges. At its southern limit in Tulare County it rises to over 10,000 feet (Mountain Lake).

2. **Pinus flexilis** James, *in* Rep. Long's Exped., vol. 2, p. 35. 1823.

Apinus flexilis Rydb., Bull. Torr. Bot. Club, vol. 32, p. 598. 1905.

Type locality.—"Arid plains subjacent to the Rocky Mountains, and extends up their sides to the region of perpetual frost."

Range.—Southern Sierra Nevada and mountains of southern California, east to New Mexico and western Texas and north to Alberta; ranges of the Great Basin.

Zone.—Canadian, rising to the lower edge of the Hudsonian.

Specimens examined.—Sedge Meadow near Mt. Whitney, Dudley 2468; Olancha Mountain, 10,400 feet, Rothrock 350; summit of Mt. Pinos, Dudley and Lamb 4593; same, Abrams and McGregor 243.

P. flexilis is usually stated to range southward from Mono Pass on the eastern slope; this station seems to rest on a single collection by Bolander (no. 6045 of the State Survey), and not since repeated. In the Gray Herbarium is a sheet of this number without the cones to supply the crucial evidence whether this is the "limber pine" or the nearly related *P. albicaulis*. A specimen collected by Lemmon on Mt. Tallac and referred to *P. flexilis* is certainly the other species.

3. **Pinus albicaulis** Engelm., Trans. St. Louis Acad., vol. 2, p. 209. 1863.

P. flexilis var. *albicaulis* Engelm., Bot. Calif., vol. 2, p. 124. 1880.
P. cembroides Newberry, Pac. R.R. Rept., vol. 6, Bot., p. 44. 1857.
Apinus flexilis Rydb., Bull. Torr. Bot. Club, vol. 32, p. 598. 1905.

Type locality.—"Passes of the Cascade mountains, about latitude 44° north."

Range.—Selkirks of British Columbia south in Cascades to high peaks of the Klamath Mountains and in the Sierra to Mt. Whitney; southeast in the northern Rockies to northwest Wyoming.

Zone.—Hudsonian.

Specimens examined.—Sierra Nevada, Pringle, September 25, 1882; Mt. Tallac at timber line, 9,750 feet, Smiley 367; same, Lemmon 1153; Mt. Rose, 9,000 feet, Heller 10,656; ridge above Gilmore Lake, Tahoe, 9,600 feet, Smiley 375; Mt. Goddard, 10,200 feet, trees 30–40 feet high, Hall and Chandler 683; same at 11,000 feet, trees 3–6 feet, Hall and Chandler 683a; Bullfrog Lake, Tulare County, 11,000 feet, Culbertson (B 4814).

P. albicaulis is the tree-line tree *par excellence* of the Sierra; while it is not infrequently found associated with other trees in the Hudsonian zone, as the climatic tree-line is approached, all its companions drop away, leaving the Whitebark Pine to mark tree-line. In such situations it often becomes so depressed as to form mats spreading over the rocks.

4. **Pinus Balfouriana** Jeffrey, Rep. Oreg. Exped., vol. 1, t. 3, f. 1. 1853.

Type locality.—Scott Mountains, northwestern California.

Range.—High Klamath Mountains and southern Sierra Nevada.

Zone.—Hudsonian.

Specimens examined.—Head of Little Kern River, 9,000 feet, Dudley and Lamb, August 4, 1895; Marble Cañon, Upper Kaweah River, Dudley 1319; north of Farewell Gap, Tulare County, Dudley 2603; south slope of Toowa Range, Hall and Babcock 5306; Olancha Mountain, on west side rises to 11,000 feet, Hall and Babcock 5246.

The Foxtail Pine is confined to the high mountains of California and is remarkable for its curiously disrupted distribution; the two areas where it is found are quite 400 miles apart by the shortest distance. No trace of the species has ever been found in the intervening country. In the southern Sierra the altitudinal range of *P. Balfouriana* is about 3,000 feet. Merriam[91] reports that on the east slope west of Owen's Valley, *P. Balfouriana* and *P. Murrayana* descend to about the 9,500-foot contour.

5. **Pinus ponderosa** var. **Jeffreyi** Vasey, Rep. U. S. Com. Agr., p. 179. 1875.

P. Jeffreyi Balfour, Rep. Oreg. Exped., vol. 2, t. 1. 1853.

Type locality.—Shasta Valley, northern California.

Range.—Southern Oregon south in the Coast Ranges to Lake County and in the Sierra to the mountains of southern California and San Pedro Martir in Lower California.

Zone.—Border of Transition and Canadian.

Specimens examined.—Glen Alpine, 6,800 feet, McGregor 207; near Fallen Leaf Lodge, Tahoe, 6,600 feet, Smiley 138a.

The Jeffrey Pine is often found growing with typical *P. ponderosa* near the upper limit of the Yellow Pine, but is easily distinguished by its much larger cones.

6. **Pinus Murrayana** Balfour, Rep. Oreg. Exped., vol. 2, t. 3, f. 2. 1853.

P. contorta var. *Murrayana* Engelm., Bot. Calif., vol. 2, p. 125. 1880.

Type locality.—"On the Siskiyou Mountains."

Range.—Alaska south in the Cascades, Coast Ranges, and Sierra Nevada to Lower California; in the Rocky Mountains through British Columbia to Colorado and Utah.

Zone.—Canadian.

Specimens examined.—Plumas County, Mrs. Austin in 1877; Sierra County, Lemmon in 1874; Donner Lake, Torrey 499; same, Dudley, June 14, 1900; Caple's Lakes, 8,500 feet, Hansen 243; plateau of Mt. Tallac, 9,200 feet, Smiley 367a; Mt. Tallac, west side at 9,500 feet, Smiley 369; Lake of the Woods, Tahoe, Dudley, September 1, 1894; Heather Lake, McGregor 174; Desolation Valley, 8,200 feet, Smiley 104; South Fork San Joaquin, 6,900 feet, Hall and Chandler 730; top of Kettle Mountain ridge, Fresno County, Dudley, August 23, 1904; Kaiser Crest, Fresno County, 9,500 feet, Smiley 632; Mt. Silliman, northwest peak, Dudley, June 29, 1896; South Fork of Kern River, 9,800 feet, Rothrock 383.

P. Murrayana has the widest range of any conifer on the western mountains. Being a prolific seeder, it is one of the first trees to pioneer upon the meadows of the Canadian and lower Hudsonian zones and, as a result, many of the finest meadows in the mountains are being blocked by a dense growth of the young tamaracks. This is especially well seen along the south side of Tuolumne meadows in the Yosemite region; at this place all stages in such an invasion and occupation of new territory by a vigorous species can be studied. *P. Murrayana* is a close ally of the North Coast *Pinus contorta* Dougl. and has been considered a form of that species, but the very different habit, distinct area, and character of the bark, seem to sufficiently differentiate it.

Pinus aristata Engelm. is a subalpine tree of the Panamint Mountains in southeastern California but has not yet been found within our area.

2. TSUGA

1. **Tsuga Mertensiana** Sarg., Silva N. Am., p. 1277, t. 606. 1898.

Pinus Mertensiana Bong., Mem. Acad. St. Petersb. VI, vol. 2, p. 45. 1832.
Abies Williamsonii Newberry, Pac. R.R. Rep., vol. 6, pt. 3, p. 53. 1857.
Tsuga Pattoniana Engelm., Bot. Calif., vol. 2, p. 121. 1880.

Type locality.—Sitka.

Range.—Southeast Alaska to California (Kings River) and east to Montana.

Zone.—Hudsonian.

Specimens examined.—Sierra County, Lemmon in 1874; Independence Lake, Dudley, June 19, 1900; Lake Lucile ridge, Tahoe, Dudley, June 27, 1900; Heather Lake, McGregor 145; summit Angora Peak, Tahoe, 8,625 feet, Smiley 38; Carson Spur, 8,500 feet, Hansen 242; Mono trail, 10,000 feet, Bolander in 1867; Cathedral Pass trail, Yosemite, Dudley, July 21, 1901; same near Tuolumne meadows, 9,400 feet, Smiley 525.

The Alpine Hemlock, the most beautiful tree of the higher mountains, occurs in small groves on most of the high ridges south and west of Mohawk Valley and most abundantly on the windward slopes for this tree requires abundant moisture for typical development. Wherever it forms pure stands the forest is dark and damp, with a floor absolutely free of any underbrush. In the Tahoe region it is frequently found at the bottom of talus slopes along the line of emergence of the seepage water.

3. ABIES

1. **Abies magnifica** Murray, Proc. Hort. Soc. Lond., vol. 3, p. 318, figs. 25–33. 1863.

A. nobilis var. *magnifica* Kellogg, For. Trees Calif., p. 29. 1882.

Type locality.—"The high unexplored part of the Sierra Nevada, to the eastward of San Francisco."

Range.—Siskiyou Mountains and Mt. Shasta south in the Sierra to the South Fork of Kern River.

Zone.—Canadian.

Specimens examined.—Sierra County, Lemmon in 1874; Summit, A. Eastwood, June 16, 1898; near Lake of the Woods, Tahoe, Dudley, September 1, 1894; Slide Mountain, Washoe County, Nevada, 7,500 feet, Heller 10666; Onion Valley, Plumas County, Rutter and Atkinson, September 1, 1899; Sentinel Dome Trail, Yosemite, Dudley, June 11, 1894; Glacier Point, J. W. Congdon, May, 1888; Mt. Raymond, 7,600 feet, Smiley 527; Fresno Dome meadows, 8,000 feet, Smiley 550; top of Kettle Mountain ridge, Dudley, August 23, 1904.

The Red Fir forms large, nearly pure stands on the western flank of the Sierra; on the eastern side it occurs locally in the Tahoe region. Besides the typical form, there is a variety with exserted bracts—var. *shastensis* Lemmon (3rd Rep. Calif. Board Forestry, p. 145. 1890)—described from the Shasta district but found sporadically throughout the range of the species. Lemmon also described (l.c.) a yellow coned variety, var. *xanthocarpa,* as distinct from the common form with purplish-brown cones.

Abies concolor Lindl. and Gorden (Jour. Hort. Soc. Lond., vol. 5, p. 210. 1850), the common White Fir, growing on all the mountains of California and extending east to Colorado, not infrequently occurs above the Transition zone in the Sierra but has its greatest development in that zone.

4. JUNIPERUS

Leaves opposite and appressed ....1. J. occidentalis
Leaves in whorls and diverging ....2. J. communis

1. **Juniperus occidentalis** Hook., Fl. Bor. Am., vol. 2, p. 166. 1839.

Type locality.—"N.W. America. Banks of the waters in the Rocky Mountains. *Lewis* (in Ph.). Common on the higher parts of the Columbia, at the base of the Rocky Mountains, where it attains a height of 60–80 feet, and a diameter of from 2–3 feet. *Douglas.*"

Range.—Southeast Washington and Idaho south in the Cascades and Sierra Nevada to the San Jacinto Mountains of southern California.

Zone.—Canadian and Hudsonian.

Specimens examined.—Sierra Valley, Dudley, August, 1909; Mt. Stanford (now called Castle Peak), Hooker and Gray in 1877; between Donner Lake and Summit, Dudley, June, 1900; above Donner Lake toward Donner Pass, Heller 7166; Sierra near Summit Valley, 7,000 feet, Pringle, September 19, 1882; Mt. Tallac, Dudley, July 9, 1893; Glen Alpine, W. W. Price, August, 1898; Suzy Lake, McGregor 112;

trail to Pyramid Peak, 8,400 feet, Smiley 102; Tragedy Springs, 8,000 feet, Hansen 241; peak above Sonora Pass, Brewer 1917; Carson Spur, 8,500 feet, Hansen; Silver Mountain Pass, Phillips and Sargent in 1878; Mono Pass, Bolander in 1866; east of Half Dome, Yosemite, Dudley, June 13, 1894; Cloud's Rest trail, 8,000 feet, Smiley 508; south slope of Lambert's Dome, Dudley, July 20, 1901; top of ridge east of Sunset meadow, Fresno County, Dudley, August 23, 1904; below Fisherman's meadow, Tulare County, Dudley 2347; Kern River, Culbertson (B 4334).

The Western Juniper is the most conspicuous constituent of the ''Krummholz'' in the central Sierra, where its intricately branched, short, gnarled trunks give a most bizarre appearance to many of the high granitic glaciated table-lands. It is more common on the east slope. It does not form pure stands of any considerable size but occurs in groups of three or four. In favorable locations it becomes a tree of low height but large diameter. On Mt. Shasta, Merriam[6] reports it as growing in the Upper Sonoran and Lower Transition life-zones. In southern California, Abrams[92] assigns it to ''an arid belt intermediate between the Transition and the Canadian zones.''

2. **Juniperus communis** L., Sp. Pl., p. 1040. 1753.

Type locality.—Europe.

Range.—Holarctic; in North America south to New England, Pennsylvania, and in the mountains to North Carolina; in the west south to New Mexico and California.

Zone.—Arctic-alpine, at least in the form here considered.

Specimens examined.—Glen Alpine trail to Mt. Tallac, 8,500 feet, Abrams 4880; top of ridge between LeConte and Heather lakes, Tahoe, 9,000 feet, Smiley 354; Pyramid Peak, W. W. Price, June 26, 1898; Ralston Peak trail, 9,000 feet, Smiley 418; Mono Pass, Brewer 1753.

The plant here considered is perhaps best referred to the var. *montana* Ait. (Hort. Kew., vol. 3, p. 414. 1789); it is by no means common in our mountains though Piper reports it as common in the Cascades of Washington.

Rehder[93] has described, from ''Siskiyou Gebirge zwischen Waldo, Oregon, and Crescent City, Kalifornien, in etwa 1,000 m. Meereshöhe,'' a variant with long whiplike branches having short laterals. The type has not been seen but no specimen examined from our region accords with the too brief description.

7. SPARGANIACEAE (BUR-REED FAMILY)

1. SPARGANIUM

1. **Sparganium angustifolium** Michx., Fl. Bor. Am., vol. 2, p. 189. 1803.

S. americanum Nutt., Gen., vol. 2, p. 203. 1818.
S. simplex var. *angustifolium* Engelm., *in* Gray, Man. ed., vol. 5, p. 481. 1867.

Type locality.—"Hab. in amnibus Canadae."

Range.—Subarctic America south to New England, New York, Colorado, and California.

Zone.—Transition to Hudsonian.

Specimens examined.—Kaweah meadows, Tulare County, growing in ponds at 9,200 feet, Purpus 5670; pools in granite south of Lake Tenaya, Yosemite, 8,300 feet, Smiley 684.

S. B. Parish (Erythea, vol. 6, p. 85. 1898) reports this from the San Bernardino Mountains.

There is another Sparganium growing in the Sierra which has been referred to *S. simplex* Huds. and also to *S. minimum* Fries, from both of which species it shows material differences. Its definitive assignment or description must be deferred till more material is available for comparison.

8. NAJADACEAE (PONDWEED FAMILY)

1. POTAMOGETON

Plants with no floating leaves; the leaves short petioled or sessile.
  Leaves linear-filiform .... 1. **P. pusillus**
  Leaves broadly ovate .... 2. **P. praelongus**
Plants with both floating and submerged leaves; the leaves usually distinctly petioled, often long petioled.
  Foliage and spikes reddish; stems mostly simple .... 3. **P. alpinus**
  Foliage and spikes green; stems branching below .... 4. **P. heterophyllus**

1. **Potamogeton pusillus** var. **tenuissimus** Mert. and Koch, Deutsch. Fl., vol. 1, p. 857. 1823.

Type locality.—European.

Range.—North temperate zone in the cooler parts; in California, this form has been found only in the high Sierra.

Zone.—Canadian?

Specimen examined.—Soda Springs, near head of the Tuolumne River, Bolander, September, 1866.

2. **Potamogeton praelongus** Wulf., *in* Roem. Arch. III, vol. 3, p. 331. 1805.

Type locality.—"Laboci Junic Julique in fluvio cognomine, et in fluvio Jschiza."

Range.—North America from the Gulf of St. Lawrence to British Columbia, south to Connecticut, Great Lakes, Iowa, Montana, and California. Northern Europe. Japan.

Zone.—Canadian.

Specimen examined.—Sierra County, Lemmon in 1874.

3. **Potamogeton alpinus** Balbis, Misc. Bot., p. 13. 1804.

Type locality.—European.

Range.—Holarctic realm; south in America to New England, Michigan, Minnesota, Colorado, and California.

Zone.—Canadian.

Specimens examined.—Silver Valley, in ponds at 7,350 feet, Brewer 1978; North Fork of Kings River, 7,000 feet, Hall and Chandler 563.

4. **Potamogeton heterophyllus** Schreb., Spicil. Fl. Lips., p. 21. 1771.

Type locality.—"In stagno ad Lindenthal," Germany.

Range.—Holarctic realm; south in America to New England, Michigan, Wyoming, and California.

Zone.—Canadian.

Specimens examined.—Soda springs, Tuolumne meadows, 8,680 feet, Brewer 1783; Whitney meadows (now called Volcano meadows), Coville and Funston 1693; Tuolumne meadows, in ponds behind Parsons Lodge, 8,600 feet, Smiley 749.

Potamogeton natans L. just reaches our lower borders (Lily Lake, Tahoe, 6,600 feet, Smiley 330).

9. JUNCAGINACEAE (Arrow Grass Family)

1. TRIGLOCHIN

1. **Triglochin maritima** L., Sp. Pl., p. 339. 1753.

Type locality.—Europe, "Habitat in Europae maritimis."

Range.—Subarctic America south to New England, New Jersey, Colorado, and California.

Zone.—Transition and Canadian.

Specimens examined.—Tuolumne meadows, about the soda springs, 8,500 feet, Smiley 734; South Fork of the San Joaquin, 7,600 feet, Hall and Chandler 636.

Triglochin palustris L., a plant widely distributed in North America and found in Washington and in the Rocky Mountain section in the higher mountains; may occur in the boreal region of the Sierra. Coville has referred no. 1433 of the Death Valley expedition to this species; this collection has not been seen by me.

Damasonium, a genus of four species belonging to the family *Alismaceae,* has one species in America; *D. californicum* Torr (Benth., Pl. Hartw., p. 341. 1856) is confined to California and is essentially a Transition species, but just rises to our lower limits (Tallac, in a wet field, 6,250 feet, Smiley 136a).

10. GRAMINEAE (Grass Family)

(All of the wild grasses growing in the boreal region of the Sierra belong to the subfamily *Poacoideae;* of its seven tribes, three, *Phalarideae, Chlorideae,* and *Bambuseae,* are unrepresented.)

Spikelets 1-flowered; the axis straight, not zigzag; rhachilla sometimes prolonged behind the palet of the uppermost floret; spikelets obviously pedunculate .... 1. **Agrostideae**
Spikelets 1-many flowered; the axis zigzag; rhachilla never prolonged behind the palet of the uppermost floret; spikelets essentially sessile .... 2. **Hordeae**
Spikelets 2-many flowered; the axis straight.
Lemma shorter than the glumes; awns dorsal or from between terminal teeth on the lemma and usually bent .... 3. **Aveneae**
Lemma longer than the glumes; awns terminal or inserted between terminal teeth on the lemma and usually straight .... 4. **Festuceae**

1. AGROSTIDEAE

Lemma with a long terminal awn or mucronate, closely investing the grain.
Fruiting lemma firm, coriaceous.
Awn twisted and persistent .... 1. **Stipa**
Awn straight or essentially so and deciduous .... 2. **Oryzopsis**
Fruiting lemma thin, membranaceous .... 3. **Muhlenbergia**
Lemma awnless or short awned, loosely investing the grain.
Inflorescence a dense spicate raceme.
Lemma awnless; the glumes sharply and stiffly awned .... 4. **Phleum**
Lemma awned below the middle; glumes awnless .... 5. **Alopecurus**
Inflorescence a more or less loose panicle.
Palet apparently 1-nerved .... 6. **Cinna**
Palet obviously 2-nerved or minute or wanting.
Lemma naked at base .... 7. **Agrostis**
Lemma with a tuft of long hairs at base .... 8. **Calamagrostis**

2. HORDEAE

Axis of spike continuous, not becoming disarticulated .... 9. **Agropyron**
Axis of spike jointed and readily separating at maturity .... 10. **Sitanion**

3. AVENEAE

The flat awn terminal from between two teeth at apex of lemma. 11. **Danthonia**
The terete awn dorsal on the lemma.
  Lemma convex, erose at tip, awned below its middle ....15. **Deschampsia**
  Lemma keeled, bidentate, awned above its middle ....13. **Trisetum**

4. FESTUCEAE

Spikelets with the upper florets sterile and conduplicate ....14. **Melica**
Spikelets with the upper florets perfect or sterile and abortive.
  Lemmas keeled, awnless; base of florets often with cobwebby hairs ....15. **Poa**
  Lemmas convex, often awned; no cobwebby hairs at base of floret.
    Nerves of the obtuse, scarious-tipped lemma prominent, parallel, 5–9.
    ....16. **Glyceria**
    Nerves of the acute green lemma unequally prominent.
      Lemma entire, mucronate or terminally awned ....17. **Festuca**
      Lemma bidentate at the apex; if awned, the awn inserted from between
        the teeth ....18. **Bromus**

1. STIPA

Awn plumose, at least near its proximal end ....1. **S. occidentalis**
Awn scabrous or puberulent, not plumose ....2. **S. minor**

1. **Stipa occidentalis** Thurb., Bot. King's Exped., p. 380. 1871.

S. stricta Vasey, Bull. Torr. Bot. Club, vol. 10, p. 42. 1883.
S. stricta var. *sparsiflora* Vasey, Contr. Nat. Herb., vol. 3, p. 51. 1892.
S. occidentalis Thurb. var. *montana* Merr. and Davy, Univ. Calif. Publ. Bot., vol. 1, p. 62. 1902.
S. oregonensis Scribn., U. S. Dept. Agr., Div. Agrost., Bull. 17, p. 130, f. 426. 1899.

Type locality.—"Yosemite Trail, California." Bolander 5038.

Range.—Washington to southern California, east to Wyoming.

Zone.—Arid Transition and Canadian.

Specimens examined.—Sierra Valley, Bolander, Keller M. D. and Co.; Soda Springs, Nevada County, 7,000 feet, *Jones 2583; Lake Valley, 6,400 feet, Abrams 4775; Mariposa and Yosemite Trail, *Bolander 5020; same locality, *Bolander 5038, "on loose disintegrated gravel"; Hockett's meadows, Tulare County, very abundant, Dudley 1256; Volcano Creek, Tulare County, Hall and Babcock 5311, at 8,000 feet; Tuolumne meadows, 8,500–9,500 feet, Hall and Babcock 3548; Mt. Rose, Nevada, dwarfed at 10,000 feet, Kennedy 983.

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* These specimens have the awn more or less plumose to the tip and form part of the basis for the variety, which so far seems not to have been detected outside of California.

2. **Stipa minor** Scribn., U. S. Dept. Agr., Div. Agrost. Bull., vol. 11, p. 46. 1898.

S. viridula Trin. var. *minor* Vasey, Contr. Nat. Herb., vol. 3, p. 50, 1892.

Type locality.—Not given.

Range.—Sierra Nevada.

Zone.—Hudsonian.

Specimens examined.—Summit Valley, 8,000 feet, Pringle, September 20, 1882; Mt. Dana, Bolander 5087.

This species is reported from Farewell Gap, Tulare County (10,500 feet), Hitchcock 3393 (Jepson, Fl. Calif., vol. 1, p. 107. 1912). It appears to be a part of *S. viridula* Thurb., Bot. Calif., vol. 2, p. 288. 1880. Professor Hitchcock (Jepson, *l.c.*) suggests that this species is probably also native in Mexico.

2. ORYZOPSIS

1. **Oryzopsis Kingii** Beal, Grasses N. Am., vol. 2, p. 229. 1896.

Stipa Kingii Bolander, Proc. Calif. Acad., vol. 4, p. 170. 1872.

Type locality.—"Meadows and open woods near Mt. Dana, seven to twelve thousand feet altitude." *Bolander.*

Range.—Central Sierra Nevada.

Zone.—Canadian and Hudsonian.

Specimens examined.—Upper Tuolumne meadows, 9,700 feet, Bolander 6097 (type); Yosemite National Park, Lemmon in 1897; meadow near Cathedral Pass trail, Yosemite, Smiley 522; Mt. Goddard, 11,000 feet, Hall and Chandler, July, 1900; Yosemite-Tenaya trail, Congdon, August 13, 1894; Black Mountain, Fresno County, 10,000 feet, Hall and Chandler 601; Mt. Silliman, meadows at 10,000 feet, Mrs. Brandegee, August 23, 1905.

Collections have also been made on Clouds' Rest (9,900 feet), *Congdon,* and in Lyell Fork Cañon, Hitchcock 3289 (Jepson, *l.c.,* p. 108).

3. MUHLENBERGIA

1. **Muhlenbergia filiformis** Rydb. Bull. Torr. Bot. Club, vol. 32, p. 600. 1905.

Vilfa depauperata Torr. var. *filiformis* Thurb., Bot. King's Exped., p. 376. 1871.

Vilfa gracillima Thurb., Bot. Calif., vol. 2, p. 268. 1880, not *M. gracillima* Torr. 1856.

Sporobolus gracillimus Vasey, Descr. Cat. Grasses U. S., p. 44. 1885.

Sporobolus filiformis Rydb., Contr. Nat. Herb., vol. 3, p. 189. 1895.

Type locality.—"Yosemite Valley, California (6091 Bolander), and near Donner Lake (565 Torrey)."

Range.—Mountains of Washington to the southern Sierra Nevada, east to Montana and Colorado.

Zone.—Transition to Hudsonian.

Specimens examined.—Lower end of Donner Lake, Heller 6863; Torrey 565; Pedlar, Amador County, 6,000 feet, Hansen 603; Yosemite Valley, Bolander 15; Lake Tenaya, 8,100 feet, Smiley 865; Tuolumne meadows, wet swales on the meadows, 8,500 feet, Smiley 741; Mt. Brewer and vicinity, Tulare County, Brewer 2827; Kings River, Lemmon, July, 1902.

4. PHLEUM

1. **Phleum alpinum** L., Sp. Pl., p. 50. 1753.

Type locality.—"Habitat in alpibus."

Range.—Holarctic and alpine in the northern hemisphere and in South America.

Zone.—Hudsonian and above.

Specimens examined.—Glen Alpine trail to Mt. Tallac, 9,000 feet, Abrams 4849; Pyramid Peak, 9,700 feet, Smiley 123; Mt. Rose, 10,000 feet, Kennedy 989; Mt. Goddard, 11,500 feet, Hall and Chandler 672; north slope of Farewell Gap, Tulare County, Culbertson (B 4577); Farewell Gap, 10,500 feet, Purpus 5251; Alta meadows, Tulare County, 10,000 feet, G. B. Grant 5333.

Phleum pratense L. is now common in many parts of the Sierra, especially along the more travelled roads, as along the Tioga Road in the Yosemite region (near White Wolf, 8,100 feet, Smiley 891; Glen Alpine, Tahoe, McGregor 195).

5. ALOPECURUS

1. **Alopecurus aristulatus** Michx., Fl. Bor. Am., vol. 1, p. 43. 1803.

Type locality.—"Hab. in palodusis Canadae."

Range.—Northern United States and Canada and extending southward in the mountains.

Zones.—Transition and Canadian.

Specimens examined.—Donner Lake, Heller 6872; Glen Alpine, 6,900 feet, in low wet swales, Smiley 201; Lake Tenaya, Yosemite, meadow south of lake, 8,100 feet, Smiley 696.

6. CINNA

1. **Cinna latifolia** Griseb., *in* Ledeb., Fl. Ross., vol. 4, p. 435. 1853.

Agrostis latifolia Trev., Groepp., Beschr. Bot. Gaert. in Breslau, p. 82. 1830.
Cinna arundinacea var. *pendula* Gray, Man., ed. 2, p. 545. 1856. Bot. Calif., vol. 2, p. 276. 1880.
Cinna Bolanderi Scribn., Proc. Phila. Acad. 1884, p. 290. 1884.

Type locality.—Not ascertained.

Range.—North temperate zone in its cooler part; in North America south to New England, Great Lakes, New Mexico, and California.

Zones.—Transition and Canadian.

Specimens examined.—Emigrant Gap, Bolander, June, 1869; Summitt (Kellogg), August 8, 1870; Mariposa Big Tree Grove, Bolander (no. 22 of small collection); Eagle Peak meadows, 7,100 feet, Smiley 494.

Cinna Bolanderi Scribn. was described as having three stamens instead of one as in the typical form; there is preserved in the Gray Herbarium a sheet of what appears to be a part of the type collection (*Bolander* 22 as above), and this shows but a single stamen in some florets, two or three in others.

7. AGROSTIS

Plants producing short rhizomes .... 1. **A. lepida**
Plants without rhizomes.
  Panicle narrow, its branches erect .... 2. **A. rossae**
  Panicle open.
    Panicle branches, or some of them, widely divergent. .... 3. **A. hiemalis**
    Panicle branches not divergent.
      Plant small, 4–18 inches tall .... 4. **A. tenuis**
      Plant large, over 20 inches tall; lower branches of panicle in distinct whorls .... 5. **A. Schiedeana**

1. **Agrostis lepida** Hitchc., *in* Jepson, Fl. Calif., vol. 1, p. 121. 1912.

Type locality.—"In open gravelly woods, Siberian Pass, Sequoia National Park, California." *Hitchcock* 3455.

Range.—Southern Sierra Nevada.

Zone.—Arctic-alpine.

Specimen examined.—Farewell Gap, 11,000–12,000 feet, Purpus 5206.

Professor Hitchcock cites several specimens, all of his own collection, from the alpine region of Mt. Whitney.

2. **Agrostis rossae** Vasey, Contr. Nat. Herb., vol. 3, p. 76. 1892.

A. varians Trin., Mem. Acad. St. Petersb. VI., vol. 4, p. 314. 1840, not of Thuill. 1790. Bot. Calif., vol. 2, p. 273. 1880.

Type locality.—Yellowstone Park, Wyoming.

Range.—Pacific Coast from Alaska to California and east to Wyoming.

Zone.—Canadian, to Arctic-alpine.

Specimens examined.—Mt. Rose, Kennedy 978; Summit Valley, 9,500 feet, Pringle, September 27, 1882; ridge south of Donner Pass, 7,500 feet, Heller 7140; Hermit Valley, Alpine County, 7,000 feet, Hansen 397; Desolation Valley, 8,500 feet, Smiley 346a; Mt. Dana, Bolander; Upper Tuolumne River, 10,000 feet, Bolander 5070; soda springs, Tuolumne meadows, Congdon, August 18, 1890; Dana Park meadows, Yosemite, 9,700 feet, Smiley 850; soda springs of the San Joaquin, Madera County, Congdon, August 20, 1895; meadows near Black Mountain, Fresno County, 10,000 feet, Hall and Chandler 611.

A. rossae is very near to *A. exarata* Trin., which is common in the Sierra in the Transition zone and locally rises into the Canadian (Mt. Raymond, dry meadow border, 7,900 feet, Smiley 539).

3. **Agrostis hiemalis** var. **geminata** Hitchc., U. S. Dept. Agr., Bur. Pl. Ind. Bull. 68, p. 44. 1905.

A. geminata Trin., Gram. Unifl., p. 207. 1824.

Type locality.—"Ex Unalaschka."

Range.—Southeastern Alaska to California and Colorado and in the north across the continent eastward to Newfoundland and eastern Canada.

Zone.—Canadian to Arctic-alpine.

Specimens examined.—Donner Lake, Heller 7149; Kern River, Rothrock 323.

4. **Agrostis tenuis** Vasey, Bull. Torr. Bot. Club., vol. 10, p. 21. 1883.

A. idahoense Nash, Bull. Torr. Bot. Club, vol. 25, p. 42. 1897.

Type locality.—"On the San Bernardino Mountains, California."

Range.—Washington to California, east to Montana and New Mexico.

Zone.—Arid Transition and Canadian.

Specimens examined.—South side of Slide Mountain, Washoe County, Nevada, 8,200 feet, Heller 10668; Desolation Valley, 8,500 feet, Smiley 96; Silver Lake, Amador County, 8,000 feet, Hansen 818; meadows near Black Mountain, Fresno County, 10,000 feet, Hall and Chandler, 601a.

5. **Agrostis Schiedeana** Trin., Mem. Acad. St. Petersb., VI, vol. 4, p. 327. 1840.

A. Hallii var. *californica* Vasey, Contr. Nat. Herb., vol. 3, p. 74. 1892.
A. elata Thurb., Bot. Cal., vol. 2, p. 274 1880, not of Trin.

Type locality.—"Mexico."

Range.—British Columbia south to the high mountains of Central Mexico.

Zone.—Transition and Canadian.

Specimen examined.—Glen Alpine, Tahoe, 6,800 feet, McGregor 33.

8. CALAMAGROSTIS

Awn long and strongly bent, exceeding the glumes; callus hairs short.
  Leaves involute-filiform: plant low (6–12 inches); panicle open. 1. **C. Breweri**
  Leaves plane or involute; plant taller (1.5–2 feet); panicle dense, spikelike .... 2. **C. purpurascens**
Awn short and straight, little or not at all exceeding the glumes; callus hairs mostly exceeding the lemma.
  Panicle open, spreading; leaf-blades flat .... 3. **C. canadensis**
  Panicle narrow or even spikelike; leaves flat or becoming involute .... 4. **C. hyperborea**

1. **Calamagrostis Breweri** Thurb., Bot. Calif., vol. 2, p. 280. 1880.

C. Lemmoni Kearney, U. S. Dept. Agri., Div. Agrost., Bull. 11, p. 16. 1898.

Type locality.—"Near summit of Carson's Pass." Brewer 2128.

Range.—Sierra Nevada.

Zone.—Hudsonian mainly.

Specimens examined.—Near summit of Carson's Pass, 8,000 feet, Brewer 2128; above Donner Pass, 7,500 feet, Heller 7130; Lemmon (without data), vicinity of Tuolumne meadows, 8,500–9,500 feet, Hall and Babcock 3627; Upper Tuolumne River, 9,700 feet, Bolander 6898; mountain at Farewell Gap, Tulare County, 11–12,000 feet, Purpus 5210.

Lemmon's specimen is the basis for *C. Lemmoni* Kearney, but I was unable to find a substantial difference in the material at hand.

2. **Calamagrostis purpurascens** R. Br., *in* Richards. Bot. App. Frankl. Jour., p. 731. 1823.

C. sylvatica A. Gray, Proc. Am. Acad., vol. 6, p. 80. 1868. Thurb., Bot. Calif., vol. 2, p. 282. 1880, not of DC.
C. sylvatica var. *americana* Vasey, Contr. Nat. Herb., vol. 3, p. 83. 1892.

Type locality.—British America between Point Lake and the Arctic Sea.

Range.—Arctic America from Alaska to Greenland and south, in the east to Quebec; in the western mountains to the Black Hills, Colorado, and California.

Zone.—Hudsonian.

Specimens examined.—Mt. Dana, 12,500 feet, Bolander 5071; foot of Mt. Dana, Congdon, August 10, 1898.

Specimens collected on Mt. Tamalpais, north of San Francisco Bay, have been referred to this species provisionally (Hitchcock *in* Jepson, *l.c.*, p. 123).

3. **Calamagrostis canadensis** Beauv., Agrost., p. 157. 1812.

Arundo canadensis Michx., Fl. Bor. Am., vol. 1, p. 73. 1803.

Type locality.—"Hab. in Canada."

Range.—Subarctic America south to California, Colorado, and New Mexico in the west; in the east southward to New England and along the mountains to North Carolina.

Zone.—Transition and above.

Specimens examined.—Donner Lake, Torrey 559; cliffs at Glen Alpine, Tahoe, 7,000 feet, McGregor 169; Angora Peak, 8,000 feet, Smiley 312; Merced River, Hildebrand 2244; Yosemite, "up to 11,000 feet," Bolander 6087; Tuolumne meadows, Yosemite, 8,500 feet, Smiley 740; 77 Corral, San Joaquin trail, Congdon, August 15, 1899.

Some of the above specimens are not typical, e.g. Torrey 559, and have been referred to the var. *acuminata* Vasey (*in* Scribn., U. S. Dept. Agri., Div. Agrost. Bull. 5, p. 26. 1897), which forms a transition to the northern *C. Langsdorfii* Trin.

4. **Calamagrostis hyperborea** Lange, Fl. Dan., vol. 50, pl. 3. 1880. Consp. Fl. Greenl., p. 160. 1880.

C. robusta Vasey, *in* Rothrock, Rep. Wheeler Exped., vol. 6, p. 285. 1878, not Muell.

Type locality.—Igalico, near Julianshaab, southern Greenland.

Range.—Arctic America south to California, New Mexico, Vermont, Eastern Quebec and Newfoundland.

Zone.—Hudsonian.

Specimens examined.—Slope above Nellie Lake, Fresno County, 8,800 feet, Smiley 611; Kaweah meadows, Tulare County, 9,200 feet, Purpus 5128; soda springs of the Tuolumne, Congdon, August 15, 1894.

9. AGROPYRON

Rhachis continuous, not separating into joints.
- Lemma awnless or merely mucronate ....1. **A. tenerum**
- Lemma awned ....2. **A. Gmelini** var. **Pringlei**

Rhachis jointed and separating when the grain is mature ....3. **A. Scribneri**

1. **Agropyron tenerum** Vasey, Bot. Gaz., vol. 10, p. 258. 1885.

Type locality.—Not given, the collections upon which the specific description is based from Fort Garland, Colorado.

Range.—Subarctic America south to New England, New Mexico, and California.

Zone.—Canadian, at least as to the specimens here considered.

Specimens examined.—Angora moraine, Tahoe, 7,300 feet, Smiley 8; Silver Mountain, 8–9,000 feet, Brewer 2068; Bloody Cañon, 9,500 feet, R. A. Ware 2714c.

2. **Agropyron Gmelini** var. **Pringlei** Scribn. and Smith, U. S. Dept. Agri., Div. Agrost. Bull. 4, p. 31. 1897.

Type locality.—"Sierra Nevada Mountains above Summit Valley."

Range.—Sierra Nevada eastward to Montana and Colorado.

Zone.—Hudsonian and Arctic-alpine.

Specimens examined.—Sierra Nevada above Summit Valley, 9,500 feet, Pringle, September 23, 1882; slope east side of LeConte Lake, Tahoe, 8,700 feet, Smiley 349; Carson Pass, 8,000 feet, Bolander 2118; Mt. Hoffman, Mariposa County, Congdon, August 20, 1890; Pyramid Peak, west side, 9,800 feet, Hall and Chandler 4718; Kaiser Crest, Fresno County, 9,100 feet, Smiley 622; rocky slopes along Little Kern River, 11–12,000 feet, Purpus 5515.

3. **Agropyron Scribneri** Vasey, Bull., Torr. Bot. Club, vol. 10, p. 128. 1883.

Type locality.—Montana.

Range.—California east to Montana and south to New Mexico.

Zone.—Arctic-alpine.

No specimen of this grass has been seen from California; it is here admitted only because reported by Hitchcock (Jepson, *l.c.*, p. 132) to have been collected on Mt. Dana by Congdon in 1898.

10. SITANION

Sheaths and dorsal surfaces of the leaves glabrous and glaucous.....1. **S. rigidum**
Sheaths and dorsal surfaces of the leaves pubescent or scabrous........
....2. **S. rigidum** var. **californicum**

1. **Sitanion rigidum** J. G. Smith, U. S. Dept. Agr., Div. Agrost. Bull. 18, p. 13. 1899.

Type locality.—"Cascade Mountains, Washington." *O. D. Allen* 178.

Range.—Washington to southern California, east to Wyoming.

Zone.—Canadian and Hudsonian, but ranging downward to Upper Sonoran.

Specimens examined.—Mt. Tallac, east side in talus rock, 9,500 feet, Smiley 240; Camp Agassiz, above Fallen Leaf Lake, Tahoe, dry rocky soil, 7,100 feet, Smiley 362; south side of Polly Dome, Lake Tenaya, Yosemite, 8,300 feet, Smiley 870; Mt. Tallac, 9,740 feet, Hall and Chandler 4628; Tinker's Knob, Placer County, 9,000 feet, C. F. Sonne 7; foot of Mt. Whitney, 12,000 feet, Rothrock 403.

Professor Hitchcock (Jepson, *l.c.*, p. 188) reduces this species to a synonym of *S. minus* J. G. Smith (*l.c.*), which was described from Jacumba, San Diego County, in the Upper Sonoran zone (collected by *Schoenefeldt* 3277). *S. rigidum* is reported growing in rock crevice on the summit of Mt. Grayback in the San Bernardino Mountains at an elevation of 11,725 feet.[94] A specimen from that station preserved in the Gray Herbarium (*W. G. Wright* 87) is, however, better referred to the following variety.

2. **Sitanion rigidum** var. **californicum** (J. G. Smith), comb. nov.

S. californicum J. G. Smith, U. S. Dept. Agr., Div. Agrost. Bull. 18, p. 13. 1899.

Type locality.—"San Bernardino Mountains, California, altitude 2,150 m."

Range.—Sierra Nevada and mountains of southern California, occurring with the species.

Zone.—Same as the species.

Specimens examined.—Mt. Lola, Tahoe, Kennedy 183; Angora Peak, Tahoe, 8,600 feet, Smiley 42; Mt. Gibbs, Yosemite, 12,200 feet, Smiley 728; Denel's Peak, timber line at 11,000 feet, Hall and Babcock 5513.

Sitanion cinereum J. G. Smith (*l.c.*, p. 14), described from "Reno, Nev.," is said to be the common grass of the glacial meadows on Mt. Shasta;[53] no specimens have been seen from the Sierra. From the description, it would appear that it differs from the var. *californicum* only by a somewhat shorter awn.

11. DANTHONIA

Sheaths pubescent; culms often geniculate; spikelets in a loose panicle ....1. **D. americana**
Sheaths glabrous; culms erect; spikelets aggregated ....2. **D. intermedia**

1. **Danthonia americana** Scribn., U. S. Dept. Agr., Div. Agrost. Circ. 30, p. 5. 1901.

D. grandiflora Phil. Anal. Univ. Chile 1873, p. 568, 1873, not of Hochst. 1851.
Merathrepta americana Piper, Contr. Nat. Herb., vol. 11, p. 123. 1906.

Type locality.—Chile.

Range.—British Columbia to the mountains of southern California, east to Wyoming. Chile.

Zone.—Transition and Canadian.

Specimens examined.—Silver Lake, Tahoe, Hansen, June 30, 1899; Angora moraine south of Fallen Leaf Lake, Tahoe, 7,100 feet, Smiley 9; Kaweah meadows, Tulare County, 9,300 feet, Purpus 5247.

2. **Danthonia intermedia** Vasey, Bull. Torr. Bot. Club, vol. 10, p. 52. 1883.

D. sericea Thurb., Bot. Calif., vol. 2, p. 294. 1880, not of Nutt.
Merathrepta americana Piper, Contr. Nat. Herb., vol. 11, p. 122. 1906.

Type locality.—Not given.

Range.—British Columbia to California and New Mexico. Gaspe Peninsula, Quebec, and Newfoundland.

Zone.—Canadian and above.

Specimen examined.—Yosemite trail, 8,000 feet, Bolander 6104.

12. DESCHAMPSIA

1. **Deschampsia caespitosa** Beauv. Agrost., p. 91, t. 18. 1812.

Aira caespitosa L., Sp. Pl., p. 64. 1753.

Type locality.—"Habitat in Europae pratis cultis & fertilibus."

Range.—Holarctic realm; south in North America to California, New Mexico, Minnesota, and New Jersey.

Zone.—Transition and Canadian.

Specimens examined.—Prattville, Plumas County, Heller and Kennedy 8790; Tamarack trail, Tahoe, meadow at 8,400 feet, Smiley 258; Lake of the Woods meadow, Tahoe, 8,200 feet, Smiley 65; Tuolumne Meadows, 8,500 feet, Smiley 750; trail to Mt. Whitney, 9,000 feet, Culbertson (B 4369).

13. TRISETUM

Awn included by the glumes or wanting .... 1. **T. Brandegei**
Awn longer than the glumes and exserted.
  Sheaths and blades pubescent .... 2. **T. spicatum**
  Sheaths and blades glabrous .... 3. **T. Congdoni**

1. **Trisetum Brandegei** Scribn., Bull. Torr. Bot. Club, vol. 10, p. 64. 1883.

T. subspicatum var. *muticum* Bolander in Thurb., Bot. Calif., vol. 2, p. 296. 1880.

T. Wolfii var. *muticum* Scribn., Rhodora, vol. 8, p. 88. 1906.

Type locality.—"Cascade Mountains," Washington. *Brandegee* and *Tweedy.*

Range.—Sierra Nevada and northward in the mountains of Oregon and Washington.

Zone.—Canadian.

Specimens examined.—Between Suzy Lake and Glen Alpine, 7,400 feet, Smiley 190; Upper Tuolumne River, 7,500 feet, Bolander 5019; Kings River, Brewer 2822a.

2. **Trisetum spicatum** Richter, Pl. Eur., vol. 1, p. 59. 1890.

Aira spicata L., Sp. Pl., p. 64. 1753, not *A. spicata* L., *op. cit.*, p. 63.

Trisetum subspicatum Beauv., Agrost., p. 88. 1812. Thurb., Bot. Calif., vol. 2, p. 296. 1880.

Type locality.—"Habitat in Lapponiae alpibus."

Range.—Nearly world-wide in distribution in high mountains.

Zone.—Canadian to Arctic-alpine.

Specimens examined.—Soda Springs, Nevada County, 7,000 feet, Jones 2923; Silver Mountain, Brewer 2044; hill above Ebbett's Pass, Brewer 2002, Summit White Chief Peak, Culbertson (B 4439); Desolation Valley, 8,700 feet, Smiley 338a; Mt. Goddard, 11,000 feet, Hall and Chandler, July, 1900; Mt. Gibbs, Yosemite, 10,800 feet, Smiley 769; Mt. Rose, Kennedy 986; base of Mt. Whitney, 12,500 feet, Rothrock 390.

Professor Fernald informs me that my numbers, here referred to *T. spicatum,* do not conform to that species, at least in its typical form, nor are they in satisfactory agreement with the var. *molle* Gray (Man., ed. 2, p. 572. 1856), a plant of eastern Canada and also found in the northwest. The above specimens are here provisionally assigned pending further study; it may prove that our Californian material will be found sufficiently distinct to justify separate recognition.

3. **Trisetum Congdoni** Scribn. and Merr., Bull. Torr. Bot. Club, vol. 29, p. 470. 1902.

Type locality.—"Shadow Lake trail, Mariposa County, California."

Range.—Sierra Nevada.

Zone.—Arctic-alpine mainly, but occurring in the Hudsonian.

Specimens examined.—Above Donner Lake toward Donner Pass, Heller 7117; Placer County, A. M. Carpenter, August-October, 1892; Mt. Rose, 10,000 feet, Kennedy 987; Desolation Valley, Tahoe, 8,600 feet, Smiley 342; Pyramid Peak, 10,020 feet, Hall and Chandler 4715; Mt. Dana, 10,400 feet, just above timber line, Smiley 717; Mt. Goddard, 11,000 feet, Hall and Chandler 709; east slope Cathedral Peak, Yosemite, 10,300 feet, Smiley 812; soda springs of the San Joaquin, Congdon, August 20, 1895, Farewell Gap, 11–12,000 feet, Purpus 5116; Sawtooth Peak, 12,100 feet, Hall and Babcock 5678; Alta meadows, G. B. Grant 5338, 5339.

Trisetum canescens Buckl., a Transition species, is occasionally collected in the boreal region of the Sierra (near White Wolf, Yosemite, 8,100 feet, Smiley 889; Cisco, Miss H. A. Walker 1500).

14. MELICA

1. **Melica stricta** Bolander, Proc. Calif. Acad., vol. 3, p. 4. 1863.

Type locality.—"Silver City, Nevada Territory." *G. W. Dunn.*

Range.—Southeastern Oregon to southern California, east to Utah.

Zone.—Canadian and Hudsonian.

Specimens examined.—Plumas County, Mrs. Austin in 1878; Castle Peak near the highest point, Heller 7076; rock crevices above Summit, 9,000 feet, Greene in 1874; Soda Springs, Nevada County, 8,000 feet, Jones 2479; Mt. Tallac, talus slope on east side, 9,000 feet, Smiley 228; Sonora Pass, 7–8,000 feet, Bolander 1921; Cloud's Rest summit, Chestnut and Drew, July 13, 1889; same locality, A. Gray in 1872; Snow Creek trail to Lake Tenaya, 7,100 feet, Smiley 665; rocky mountain slopes on Little Kern River, 10–11,000 feet, Purpus 5112.

15. POA

Plants annual; lemma sparsely webbed at base ....1. **P. Bolanderi**
Plants perennial; lemmas not at all webbed at base.
  Plants with creepng rhizomes ....2. **P. Olneyae**
  Plants without creeping rhizomes.
    Panicle branches divergent; culms over 1 foot high ....3. **P. gracillima**
    Panicle branches ascending (panicle spiciform); culms less than 1 foot high.
      Lemma merely scabrid on the keel and lateral nerves ....4. **P. Pringlei**
      Lemma pilose on the lower half of keel and lateral nerves 5. **P. Pattersoni**

1. **Poa Bolanderi** Vasey, Bot. Gaz., vol. 7, p. 32. 1882.

Type locality.—Not given. Ostrander's, above the Yosemite Valley, as appears from the label of Bolander's collection.

Range.—Washington to California, east to Alberta and Utah.

Zone.—Canadian.

Specimens examined.—Sierra Nevada, 8,000 feet, Greene, October 13, 1874; Soda Springs, Jones in 1881; Ostrander's, Yosemite, Bolander 6115; Hockett's meadows, Culbertson (B 4436).

Specimens referrable to the var. *Chandleri* Piper (Contr. Nat. Herb., vol. 11, p. 132. 1906) have not been seen from the Sierra though they doubtless occur, since this ill-defined form, distinguished only by a smaller panicle than is normal for the species, has been collected both to the north and south of our region.

2. **Poa Olneyae** Piper, Erythea, vol. 7, p. 101. 1899.

Type locality.—"Base of basalt cliffs in pine woods, Spokane, Wash."

Range.—Washington to California?

No authentic specimens of this species have been seen by me and it is here included as a component of the Sierra boreal flora only because certain collections from the high Sierra are so referred (Jepson, *l.c.*, p. 154).

3. **Poa gracillima** Vasey, Contr. Nat. Herb., vol. 1, p. 272. 1893.

P. invaginata, Scribn. and Williams, U. S. Dept. Agr., Div. Agrost. Circ. 9, p. 6. 1899.

Type locality.—Mt. Adams, Washington.

Range.—British Columbia to California.

Zone.—Hudsonian.

Specimens examined.—High mountain near Donner Pass, Torrey 572; Mono trail, among rocks, Bolander 6014; Ebbett's Pass, Bolander 2077; Mt. Dana, 11,000 feet, Bolander 5076; near Lake Tenaya, 8,300 feet, Hall and Babcock 3503.

4. **Poa Pringlei** Scribn., Bull. Torr. Bot. Club, vol. 10, p. 31. 1883.

Type locality.—"Mountains about the headwaters of the Sacramento River, California." *Pringle.*

Range.—Mt. Shasta region through the high Sierra to the Tehachapi Mountains.

Zone.—Canadian rising into the Hudsonian.

Specimens examined.—Above Summit Valley, 9,500 feet, Pringle, September 27, 1882; ridge south of Donner Pass, 8,500 feet, Heller 7,157; Suzy-Heather Lake trail, Tahoe, 8,000 feet, Smiley 164; Tuolumne meadows, Congdon, August 18, 1890; Mt. Whitney, Coville and Funston 2066.

4a. **Poa Pringlei** var. **Hanseni** (Scribn.), comb. nov.

P. Hanseni Scribn., U. S. Dept. Agr., Div. Agrost. Bull. 11, p. 53. 1898.

Type locality.—"Silver Lake, Amador County, Cal."

Range.—Same as the species but at somewhat higher elevations.

Zone.—Arctic-alpine mainly.

Specimens examined.—Mt. Rose, summit, Kennedy 1165; same locality at 10,300 feet, Heller 10,651.

This variety differs from *P. Pringlei* only in the dwarf size and filliform leaves.

5. **Poa Pattersoni** Vasey and Scribn., Contr. Nat. Herb., vol. 1, p. 275. 1893.

Type locality.—"Mountains of Colorado, near Grays Peak, 11,000 to 14,000 ft. altitude."

Range.—Central Rocky Mountains of Colorado and Wyoming: west to California?

Zone.—Alpine in the Rockies (acc. Nelson in Coulter-Nelson, Man., p. 71).

Specimens examined.—Pyramid Peak, 9,500 feet, Smiley 344; Desolation Valley, 8,000 feet, Smiley 95; Tamarack trail, Tahoe, meadow at 8,000 feet, Smiley 262.

These specimens, all from the east slope of the Sierra (where several boreal Rocky Mountain species rarely occur), are referred here rather than to *P. Pringlei,* where closely similar forms have been placed, because of the well developed pilosity upon the keel and lateral nerves of the lemma, which in typical *P. Pringlei,* and its variety, is merely scabrid. Beal (N. Am. Grasses, vol. 2, p. 578) considered these species identical.

Poa arctica R. Br. was once reported from Soda Springs, Nevada County,[95] but is not otherwise known south of Washington.

Poa saxatilis Scribn. and Williams, an arctic-alpine species of Washington is said by Scribner[96] to be represented in typical form by *Hansen* 1963; I do not know whether or not this is the G. E. Hansen who collected and distributed so many numbers from the central Sierra Nevada.

Other Poas from the alpine districts of the Sierra have been referred to *P. Leibergii* Scribn. and *P. Cottoni* Piper (Jepson, *l.c.,* p. 160), both described from the Arid Transition of eastern Oregon and Washington. I have not seen the specimens.

16. GLYCERIA

1. **Glyceria pauciflora** Presl., Rel. Haenke., vol. 1, p. 257. 1830.

Panicularia pauciflora Kuntze, Rev. Gen., vol. 2, p. 783. 1891.
Glyceria erecta Hitchc., *in* Jepson, Fl. Calif., vol. 1, p. 161. 1912.

Type locality.—"In sinu Nootka."

Range.—Alaska (Yakutat Bay) southward and eastward to California and Colorado.

Zone.—Transition and Canadian.

Specimens examined.—Summit Valley, 8,000 feet, Pringle, September 23, 1882; Truckee River, Heller 7113; Donner Lake, Heller 6987; Farewell Gap, 10–11,000 feet, Purpus 5151; near Whitney meadows, Coville and Funston, 1676.

The type of *G. erecta* came from Sunrise Creek above Yosemite.

Glyceria elata Hitchc. (*in Jepson,* Fl. Calif., vol. 1, p. 162; *Panicularia elata* Nash, *in Rydb.,* Mem. N. Y. Bot. Gard., vol. 1, p. 54. 1900, described from "Sweet Grass Canyon, Crazy Mountains, Montana), a variant of *G. nervata* Trin., from which it is distinguished by broader leaves and a more vigorous habit of growth, but connected in the Northwest with typical *G. nervata* by numerous intermediate forms (cf. Piper, Fl. Wash.—Contr. Nat. Herb., vol. 11, p. 140), occurs in both the Coast Ranges and Sierra Nevada in the Transition, and not infrequently rises into the boreal region along streams or in rich meadows (Angora Peak, 7,500 feet, Smiley 309; Suzy Lake trail, Tahoe, 7,100 feet, Smiley 199; Scandinavian Cañon, 7,000 feet, Brewer 2061).

17. FESTUCA

Blades narrow, flat, or loosely involute; lemma membranaceous .....1. **F. viridula**
Blades closely involute or sulcate; lemmas coriaceous .....2. **F. ovina**

1. **Festuca viridula** Vasey, U. S. Dept. Agr., Div. Bot. Bull, 13, pl. 93. 1893.

F. gracillima Thurb., Bot. Calif., vol. 2, p. 318. 1880, not Hook.

Type locality.—"California," presumably near Summit.

Range.—Mountains of Washington and Idaho, south through Oregon and northern California to the central Sierra Nevada.

Zone.—Canadian.

Specimens examined.—Sierras, 5–8,000 feet, Bolander, Kellogg and Co. in 1872; ridge south of Donner Pass, 8,500 feet, Heller 7154; Suzy Lake, Tahoe, 7,800 feet, Smiley 185; Donner Lake, J. B. Davy 3222.

2. **Festuca ovina** var. **supina** Hack., Bot. Centralbl., vol. 8, p. 405. 1881.

F. Supina Schr., Enum Pl. Transs., p. 784. 1866.

Type locality.—"Auf Felsen und Gerölle der Hochalpen," Transsylvania.

Range.—Holarctic; in America south to Newfoundland on the east coast; in the west along the mountains to New Mexico and southern California.

Zone.—Arctic-alpine.

Specimens examined.—Mt. Rose, 10,000 feet, Kennedy 984; Mt. Gibbs, 11,000 feet, Smiley 786; Mt. Dana, Hall and Babcock 3608; Denel's Peak, 11,000 feet, Hall and Babcock 5514; near Farewell Gap, 11–12,000 feet, Purpus 5117, 3076; Sawtooth Peak, 12,250 feet, Hall and Babcock 5676.

2a. **Festuca ovina** var. **brachyphylla** Piper, Contr. Nat. Herb., vol. 10, p. 27. 1906.

F. brachyphylla Schult., Mant. vol. 3, p. 646. 1827.

Type locality.—"In Melville Island" (Arctic Archipelago).

Range.—In America south from the Arctic regions to California. New Mexico, northern New England and Newfoundland.

Zone.—Arctic-alpine.

Specimens examined.—Mt. Dana, 12,500 feet, Brewer (State Survey no. 5066); Bolander (State Survey no. 6100).

A collection made on the Mt. Lyell trail, Yosemite, 10,900 feet, is possibly of this variety (Smiley 524).

17. BROMUS

Spikelet terete; panicle strict and rather dense ....1. **B. Suksdorfii**
Spikelet strongly compressed; panicle spreading. 2. **B. marginatus** var. **seminudus**

1. **Bromus Suksdorfii** Vasey, Bot. Gaz., vol. 10, p. 223. 1885.

Type locality.—"In Washington Territory, and also by Mr. Cusick in Oregon; altitude about 7,000 ft."

Range.—Washington to the southern Sierra Nevada.

Zone.—Canadian.

Specimens examined.—Near Silver Mountain trail, 8–9,000 feet, Brewer 2088; Calaveras County, Hillebrand 2258; above Donner Lake toward Donner Pass, Heller 7120.

2. **Bromus marginatus** var. **seminudus** Shear, U. S. Dept. Agr., Div. Agrost. Bull. 23, p. 55. 1900.

Type locality.—"On open mountain side 5 miles above Wallowa Lake, Oregon."

Range.—Washington to southern California, east to Montana and Wyoming.

Zone.—Transition and Canadian.

Specimens examined.—Kaweah meadows, Tulare County, 9,400 feet, Purpus 5124.

11. CYPERACEAE (SEDGE FAMILY)

Flowers perfect.
  The enlarged base of the style persisting upon the mature achene
  ....1. **Eleocharis**
  The style deciduous entire from the mature achene.
    Bristles few (not more than 6 in ours) ....2. **Scirpus**
    Bristles very numerous, long, white-silky ....3. **Eriophorum**
Flowers unisexual ....4. **Carex**

1. ELEOCHARIS

Culms setaceous, from very slender rootstocks; scales of the spike acute.
....1. **E. acicularis**
Culms stouter, from larger rootstocks; scales of the spike obtuse.
....2. **E. Bolanderi**

1. **Eleocharis acicularis** R. and S., Syst., vol. 2, p. 154. 1817.

Scripus acicularis L., Sp. Pl., p. 48. 1753.

Type locality.—European.

Range.—North temperate zone.

Zone.—Transition mainly, rising into the Canadian.

Specimens examined.—Yosemite, Torrey 553; Milburn, Mariposa County, Congdon, June 8, 1890.

This species is reported[50] from the southern Sierra, Mt. Whitney region, from an altitude of 3,000 m., but the specimen has not been seen by me.

2. **Eleocharis Bolanderi** Gray, Proc. Am. Acad., vol. 7, p. 392. 1868.

Type locality.—"Mariposa County, on banks of stream near Clarks." (Yosemite.)

Range.—Sierra Nevada.

Zone.—Transition and above.

Specimen examined.—Sierra Nevada near snow at 9,500 feet, Greene 448; the specimen is immature and is doubtfully referred.

2. SCIRPUS

Spikelets solitary and terminal.
- Involucral bract present.
  - Bristles longer than the achene; culms naked ....1. **S. Clementis**
  - Bristles shorter than the achene; culms leafy ....2. **S. yosemitanus**
- Involucral bract wanting ....3. **S. pauciflorus**

Spikelets numerous.
- Spikelets in a dense glomerule ....4. **S. criniger**
- Spikelets in an open umbellate inflorescence ....5. **S. microcarpus**

1. **Scirpus Clementis** Jones, Contr. W. Coast Bot., vol. 14, p. 21. 1912.

Type locality.—"Rae Lake, King's River, California, alpine."

No specimen of this species has been seen; it is here admitted only because, to judge from the description, it and the following species represent in our region *S. caespitosus* L.

2. **Scirpus yosemitanus** sp. nov.

Culmi dense caespitose, 6–10 cm. alti, gracile, tenue, valde striati. Folium unicum culmo multo brevius, convolutum rigidum, laeve glaucescens. Spicula parvula (3–4-flora) unica terminalis bracteata. Squamae oblongae valde obtusae vel subtruncatae, inferiores clarius castatae sed non aristatae. Achenium obovatum cum apice conica. Setae 3 ligulatae, planae achenio breviores.

(Culms densely matted, 6–10 cm. high, with old sheathing leaf-bases, slender, terete, very prominently striate, somewhat glaucous and having a single blunt thick terete leaf, 2–3 cm. long at about the middle. Spikelet small solitary and terminal, 3–4-flowered, subtended by a bract about twice as long. Scales oblong, very blunt or squarrose, the lower and outer very prominently ribbed but not awned. Achene obovate, with a conical distal end surrounding the base of the style. Bristles 3, ligulate, smooth, shorter than the achene.)

Type from Tuolumne meadows, Yosemite National Park; collected by J. W. Congdon, August 8, 1898.

This species differs from *S. caespitosus* L. in the bristles being 3, not 6; from *S. Clementis* Jones, it may be distinguished by the single blunt leaf about midway on the culm. In *S. Clementis* the culm is naked.

3. **Scirpus pauciflorus** Lightf., Fl. Scot., p. 1078. 1777.

Eleocharis pauciflora Link., Hort. Berol., vol. 1, p. 284. 1827. Bot. Calif., vol. 2, p. 221. 1880.

Type locality.—Highlands of Scotland, "as upon Malgbyrdy in Breadalbane."

Range.—In America, British Columbia to Newfoundland, south to California, Colorado, and northeastern United States.

Zone.—Transition to Hudsonian.

Specimens examined.—Desolation Valley, Tahoe, 8,500 feet, Smiley 334; soda springs, Upper Tuolumne River, Brewer, 1780; Bonita meadow, Tulare County, Hall and Babcock, 5181.

Coville[50] reports this from Whitney meadows, Tulare County, at 2850 m.

4. **Scirpus criniger** Gray, Proc. Am. Acad., vol. 7, p. 392. 1867.

Type locality.—"In bogs on Red Mountain, Humboldt Co."

Range.—Sierra Nevada and North Coast Ranges northward into southern Oregon.

Zone.—Hudsonian mainly.

Specimens examined.—Plumas County, Mrs. Austin in 1878; Placer County, A. N. Carpenter in 1892; Pyramid Peak, east side at 9,700 feet, Smiley 128; foot of Mt. Dana, Congdon, August 10, 1898; Elizabeth Lake, Tuolumne meadows, growing on the peat marsh, 9,800 feet, Smiley 800; Monarch Creek near Mineral King, Tulare County, 9,000 feet, Hall and Babcock 5699.

5. **Scirpus microcarpus** Presl., Rel. Haenke., vol. 1, p. 195. 1823.

Type locality.—Nootka Sound, Vancouver Island.

Range.—Subarctic America south to California, New Mexico.

Zone.—Transition and Canadian.

Specimens examined.—Plumas County, Mrs. Austin in 1878; ravine near Fallen Leaf Lake, Tahoe 6,700 feet, Smiley 363; Walker Lake, 7,930 feet, R. A. Ware 2711c.

The range of this species is usually stated to extend to the Great Lakes and the mountains of New York and New England, but, according to Professor Fernald, the plant of the northeastern United States shows material difference from the typical plant of the west and he has therefore described it as *S. rubrotinctus* (Rhodora, vol. 2, p. 20, 1905). M. E. Jones[97] later reduced this species to a variety of *S. microcarpus.*

3. ERIOPHORUM

1. **Eriophorum gracile** Roth., var. **caurinum** Fernald, Rhodora, vol. 7, p. 67. 1905.

Type locality.—"Oregon, subalpine regions."

Range.—Oregon southward to Mt. Shasta and the northern Sierra Nevada.

Zone.—Canadian.

Specimens examined.—Sierra County, Lemmon in 1874; Big Trees, Hildebrand 2331.

4. CAREX

- A.1 Spikelets solitary and terminal.
  - Female scales persistent, concealing the mature perigynia; leaves filiform-involute or carinate.
    - Stigmas 2 .... 1. **C. capitata**
    - Stigmas 3.
      - Perigynia neither chartaceous nor inflated; spikes narrowly cylindrical .... 2. **C. filifolia**
      - Perigynia chartaceous, inflated, and very thin; spikelets pyramidal. .... 3. **C. Breweri**
  - Female scales falling, exposing the maturing perigynia; leaves nearly flat .... 4. **C. nigricans**
- A.2 Spikelets 2–many.
  - B.1 Stigmas 2; spikelets all or nearly all bisexual, or dioecious and sessile; achene lenticular in cross-section; male flowers few and inconspicuous.
    - Staminate flowers borne at top of the spikelets.
      - Plants with long creeping rhizomes.
        - Perigynium with a short minute beak .... 5. **C. simulata**
        - Perigynium long-beaked.
          - Spikelets in a dense, broad, compact head; scales not at all or only narrowly hyaline-margined .... 6. **C. vernacula**
          - Spikelets forming an oblong continuous spike; scales with broad hyaline margins .... 7. **C. siccata**
      - Plants caespitose with scarcely spreading rootstocks.
        - Ferrugineous scales of the spikelets scarious margined and with green midribs .... 8. **C. Hoodii**
        - Scales of the spikelets not scarious margined.
          - Acute scales of the spikelets reddish-yellow with straw-colored keels; culms weak, somewhat compressed .... 9. **C. nervina**
          - Blunt scales of the spikelets brown; culms stiff, sharply angled and rough .... 10. **C. Jonesii**
    - Staminate flowers borne at base of the spikelets.
      - Perigynium not wing-margined (slightly winged at base in *C. illota*).
        - Spikelets few and rather loosely flowered.
          - Scales green, acute, and marginless; spikelets remote; plant stoloniferous .... 11. **C. tenella**
          - Scales reddish, blunt, and white margined; spikelets approximate; plant not stoloniferous .... 12. **C. heleonastes**

Spikelets several and densely flowered.
Perigynium long-beaked.
Spikelets densely congested into a capitate cluster at top of culm .... 13. **C. illota**
Spikelets, at least some of them, remote.
Spikelets, except the terminal, somewhat globose or stellate and scattered along the upper part of culm; scales ovate .... 14. **C. stellulata**
Spikelets oblong (up to ¾ inch long) or linear-cylindrical; scales acute and often hispidly awned .. 15. **C. Bolanderi**
Perigynium short-beaked .... 16. **C. canescens**
Perigynium wing-margined.
Spikelets aggregated into a more or less dense head.
Bracts subtending the head greatly elongated .... 17. **C. athrostachya**
Bracts not greatly elongated, sometimes obsolete.
Perigynium acuminately rostrate; scales obtusish .... 18. **C. Macloviana**
Perigynium abruptly rostrate; scales acute .... 19. **C. straminiformis**
Spikelets more or less remote, at least some of them quite distinct.
Scales not scarious margined.
Beak of perigynium short and wing smooth .... 20. **C. straminea** var. **mixta**
Beak of perigynium longer and wing scabrid .... 21. **C. specifica**
Scales broadly scarious margined.
Beak gradually attenuate, bidentate at the tip .... 22. **C. tahoensis**
Beak abruptly rostrate and deeply cleft .... 23. **C. Liddonii**

B.^{2} Stigmas 3, or rarely 2 and then at least some of the spikelets pedunculate.
Stigmas 2; achene plano-convex or lenticular in cross-section.
Perigynium becoming fleshy when mature .... 24. **C. aurea**
Perigynium not becoming fleshy when mature.
Perigynium strongly ribbed .... 25. **C. nebraskensis** var. **praevia**
Perigynium not strongly ribbed.
Perigynium turgid; plants from stiff woody rootstocks; culms stiff and obtusely angled; beak of perigynium minute and erect .... 26. **C. rigida**
Perigynium not turgid; plants caespitose, sometimes with slender rootstocks; culms weak and sharply angled.
Plant somewhat glaucous; spikelets short and thick .... 27. **C. Goodenovii**
Plant green; spikelets linear-cylindrical.
Scales acutish, black, unmargined; plant 16–30 inches high. .... 28. **C. acutina**
Scales obtuse, dark red, scarious margined; plant 8–16 inches high .... 29. **C. Kelloggii**
Stigmas 3; achene triangular in cross-section.
Leaves septate-nodulose, sometimes only slightly so.
Perigynium more or less gradually tapering to the beak; culm sharply angled below the spikelets and scarcely spongy at base .... 30. **C. vesicaria**
Perigynium abruptly rostrate; culm obtusely angled, thick, and spongy at base .... 31. **C. rostrata**
Leaves not septate-nodulose.
Perigynium pubescent or hispid.
Beak of perigynium entire; leaf and its sheath densely pubescent .... 32. **C. yosemitana**
Beak of perigynium bidentate; leaf and its sheath nearly glabrous or only scabrid on the margins.
Beak of perigynium short .... 33. **C. lanuginosa**
Beak of perigynium longer .... 34. **C. Congdoni**
Perigynium glabrous (except in var. *brevipes* of *C. Rossi*).
Upper spikelet bisexual, male at base.
Spikelets all but the lowest sessile; culms rigid; scales purple margined with yellow mid-nerve; perigynium prominently nerved .... 35. **C. Buxbaumii**

Spikelets pedunculate; culms weaker, often partially nodding; scales dark red or purple; perigynium nerveless.
  Spikelets very shortly pedunculate or sessile, aggregated into a capitate cluster.
    Scales acute but not awned by the projecting nerve; perigynium sometimes slightly scabrid ..36. **C. quadrifida**
    Scales aristate, often with a distinct awn formed by the projecting nerve; perigynia somewhat granulate. ....37. **C. nova**
  Spikelets distinctly peduncled, the lower often drooping. ....38. **C. atrata**
Upper spikelet male throughout (rarely *C. luzulaefolia* has a few female flowers in the male spikelets).
  Whole plant (except the perigynium and scales) whitish or glaucous pubescent ....39. **C. Whitneyi**
  Plants glabrous or essentially so.
    Most of the spikelets radical, few flowered, and hidden among the leaves ....40. **C. Rossi**
    All of the spikelets conspicuous.
      Perigynium prominently beaked; culm obtusely angled and smooth; plants not stoloniferous ....41. **C. luzulaefolia**
      Perigynium shortly beaked; culm sharply angled, usually scabrous; plants stoloniferous.
        Perigynium nerved, equalling or exceeding the scales.
          Leaves somewhat glaucous, ¼-⅓ inch wide ....42. **C. Raynoldsii**
          Leaves green, 1/12 inch or less wide ....43. **C. limosa**
        Perigynium nearly nerveless, usually shorter than the scale ....44. **C. invisa**

1. **Carex capitata** L., Syst. Nat., ed. 10, p. 1261. 1759.

Type locality.—European.

Range.—Holarctic realm; in North America very rare, especially in the west; so far known only from Wyoming and California; also Mt. Rose, Nevada.

Zone.—Arctic-alpine.

Specimen examined.—Mt. Goddard, 11,500 feet, Hall and Chandler 673.

Heller (Muhl., vol. 6, p. 77) reports this species from Mt. Rose.

2. **Carex filifolia** var. **erostrata** Kükenth., Pflanzenr., Bd. 24, Heft 20, p. 86. 1909.

Type locality.—"Sierra Nevada."

Range.—Sierra Nevada.

Zone.—Canadian to Hudsonian, and rarely in the alpine meadows.

Specimens examined.—Cisco, Kellogg, June 24, 1870; Echo Lake, Brainerd 111; Sierra County, Lemmon, May, 1875; Mono Pass, 11,000 feet, Brewer 1733; Tamarack trail, Tahoe, abundant in meadows, 8,400 feet, Smiley 270; soda springs of the Tuolumne, Brewer 1697; Elizabeth Lake meadows, Yosemite, 9,800 feet, Smiley 797; Mt. Lyell, 10,900 feet, Hall and Babcock 3581; Dana Fork meadows, Yosemite, 9,800 feet, Smiley 854.

Mr. K. K. Mackenzie considers our Californian plant to be specifically distinct from *C. filifolia* Nutt. and has accordingly described it as *C. exserta* (Bull. Torr. Bot. Club, vol. 42, p. 620. 1915), an evaluation of its divergent characters in which I am unable to concur.

3. **Carex Breweri** Boott, Ill. Car., vol. 4, p. 142, t. 455. 1867.

Type locality.—"California on Mount Shasta, 7,000–10,000 ft. in dry volcanic soil." Brewer 1422.

Range.—Sierra Nevada and mountains of northern California, north to Mt. Hood.

Zone.—Arctic-alpine, rarely lower.

Specimens examined.—Dick's Peak, Tahoe, just below summit, 10,000 feet, Smiley 434; Mt. Dana, Congdon, August 27, 1895; Elizabeth Lake meadow, Yosemite, 9,800 feet, Smiley 798; Sawtooth Peak, 12,000 feet, Hall and Babcock 5680; Mt. Dana, Bolander in 1866.

4. **Carex nigricans** C. A. Meyer, Mem. Acad. St. Petersb., vol. 1, p. 210, t. 7. 1831.

Type locality.—"Habitat in Unalaschka."

Range.—Alaska to California and Colorado. East Asia?

Zone.—Hudsonian.

Specimens examined.—Lake Lucile, Tahoe, 8,300, Hall and Chandler 4664; Devil's Basin, Eldorado County, 8,300 feet, Brainerd, July 18, 1897; summit of Rush Creek Divide, east of Minarets, Mariposa County, Congdon, August 21, 1899.

5. **Carex simulata** Mackenzie, Bull. Torr. Bot. Club, vol. 34, p. 604. 1907.

Type locality.—"Wyoming: Chug Creek, Albany County." *A. Nelson* 7316.

Range.—Washington to California, east to Montana and New Mexico.

Zone.—Canadian.

Specimens examined.—Eldorado County, bogs near Echo Postoffice, 5,800 feet, Brainerd, July 12, 1897; east slope Sonora Pass, 8,000 feet, *Brewer* 1865.

6. **Carex vernacula** Bailey, Bull. Torr. Bot. Club, vol. 20, p. 417. 1893.

Type locality.—Not given.

Range.—Washington to California and east to Utah, perhaps to Colorado.

Zone.—Hudsonian and Arctic-alpine.

Specimens examined.—Ebbett's Pass, Brewer 2066; Summit Camp, Kellogg, July 22, 1870; Sierra Nevada above Summit Valley, Pringle 1102; Mt. Goddard, Yosemite, 11,000 feet, Hall and Chandler 694; Shadow Lake trail east of Minarets, Mariposa County, Congdon, August 20, 1899; Upper Kern River near Langley's Camp, 11,800 feet, Hall and Babcock 5545.

This is the *C. foetida* of Bot. Calif., vol. 2, p. 232; Kükenthal in his revision reduces *C. vernacula* to a variety of *C. foetida* Allioni.

7. **Carex siccata** Dew., Amer. Jour. Sci., ser. 1, vol. 10, p. 278, t. F, fig. 18. 1826.

Type locality.—"Grows on the sandy plains in Westfield, Mass."

Range.—Across the continent in the northern United States and south in the western mountains.

Zone.—Canadian.

Specimen examined.—Hill above Ebbett's Pass, Brewer 2728.

8. **Carex Hoodii** Boott, *in* Hook., Fl. Bor. Am., vol. 2, p. 211. 1840.

Type locality.—"Columbia River."

Range.—Washington and British Columbia south to California and east to Montana and Wyoming.

Zone.—Arid Transition and Canadian.

Specimens examined.—Meisner's Ranch, Eldorado County, 7,600 feet, Brainerd 150; soda springs, Tuolumne River, 9,000 feet, Brewer 1702; Yosemite, Bolander 6215, 6218; Tuolumne meadows, 8,500 feet, Smiley 752.

9. **Carex nervina** Bailey, Bot. Gaz., vol. 10, p. 203, t. 3. 1885.

Type locality.—"Summit Camp, California." *Dr. Kellogg.*

Range.—Pacific Coast states.

Zone.—Canadian.

Specimens examined.—Emigrant Gap. M. E. Jones, February, 1883; Summit Camp, Kellogg, July 10, 1870; Brian's meadow, Eldorado County, 8,500 feet, Brainerd 133; Yosemite, 7,300 feet, Hall and Babcock 3456; Indian trail above Yosemite, Congdon, August 28, 1899; Upper San Joaquin River, Madera County, Congdon, August 17, 1895.

10. **Carex Jonesii** Bailey, Mem. Torr. Bot. Club, vol. 1, p. 16. 1889.

Type locality.—"Soda Springs, Nevada Co., Cal., 7,000 feet." *Jones.*

Range.—Pacific Coast states; east to Wyoming.

Zone.—Canadian.

Specimens examined.—Yuba Pass, 6,500 feet, Hall and Babcock 4519; Truckee River, meadows at 7,000 feet, Davy, June 25–30, 1897; Volcano Creek, Tulare County, 7,500 feet, Hall and Babcock 5447; Salmon Creek, Tulare County, 7,000 feet, Hall and Babcock 5167; Olancha Mountain, Tulare County, 10,000 feet, Hall and Babcock 5250.

11. **Carex tenella** Schkuhr, Riedgr., p. 23, f. 104. 1801.

Type locality.—Not given.

Range.—Holarctic realm; in America south to California, Utah, Colorado, Michigan, and New Jersey.

Zone.—Canadian or highest Transition.

Specimen examined.—Butterfly Valley in meadow with *Darlingtonia,* Lemmon 1246.

No. 1697 of the Death Valley collection, a specimen not seen by me, was refered here by Dr. Bailey.

12. **Carex heleonastes** Ehrh., L., f. Suppl., p. 414. 1781.

Type locality.—Not ascertained.

Range.—Subarctic America and southward in the mountains. Europe.

Zone.—Canadian?

Specimen examined.—Lake near Ebbett's Pass, 8,200 feet, Brewer 2063.

13. **Carex illota** Bailey, Mem. Torr. Bot. Club, vol. 1, p. 15. 1889.

Type locality.—Not given, but the type specimen collected in Colorado.

Range.—Pacific Coast east to Wyoming and Colorado.

Zone.—Canadian mainly.

Specimens examined.—Devil's Basin, Eldorado County, 8,000 feet, Brainerd 177; Lake Andrian, Eldorado County, 7,500 feet, Brainerd 175; high mountain near Donner Pass, Torrey 550; Yosemite, Congdon, August 15, 1890.

14. **Carex stellulata** var. **ormantha** Fernald, Rhodora, vol. 4, p. 222. 1902.

C. echinata var. *ormantha* Fernald, Proc. Am. Acad., vol. 37, p. 483. 1902.
C. echinata W. Boott, *in* Wats., Bot. Calif., vol. 2, p. 237. 1880, in part.

Type locality.—"California, bogs along Strawberry Creek, Eldorado Co., alt. 1815 m." *Brainerd* 180.

Range.—Subarctic America southward to the Middle States and in the west at least to California.

Zone.—Transition and Canadian.

Specimens examined.—Bog along Strawberry Creek, Eldorado County, 5,000 feet, Brainerd 160; Big Trees, Calaveras County, Bolander 2324; Lake of the Woods meadow, Tahoe, 8,000 feet, Smiley 52.

15. **Carex Bolanderi** Olney, Proc. Am. Acad., vol. 7, p. 393. 1868.

Type locality.—"California, Yosemite Valley and Mariposa Bigtree Grove."

Range.—British Columbia to southern California, east to Montana and New Mexico.

Zone.—Transition and Canadian.

Specimens examined.—Strawberry Creek, Eldorado County, 5,900 feet, Brainerd, July 20, 1897; Clear Creek Cañon, Ormsby County, Nevada, Baker 1250; White Wolf, Yosemite, 8,100 feet, Smiley 892.

16. **Carex canescens** L., Sp. Pl., p. 974. 1753.

Type locality.—Europe.

Range.—Subarctic America and south to Colorado and California in the west.

Zone.—Canadian?

Specimen examined.—About Walker Lake, Mono County, 7,930 feet, R. A. Ware, 2709c.

Death Valley no. 1506, a specimen not seen by me, was referred to the var. *dubia* Bailey (Bot. Gaz., vol. 9, p. 119. 1884)—see Contr. Nat. Herb., vol. 3, p. 214.

17. **Carex athrostachya** Olney, Proc. Am. Acad., vol. 7, p. 393. 1866.

Type locality.—"California, Yosemite Valley."

Range.—British Columbia to California and Colorado.

Zone.—Canadian.

Specimens examined.—Lake Tahoe to Bear Valley, Kellogg; trail to Snow Cascade, Eldorado County, 8,000 feet, Brainerd 232; lower end Donner Lake, Heller 6915; mountain near Kaweah River, 10–11,000 feet, Purpus 5144.

18. **Carex Macloviana** d'Urv., *in* Mem. Soc. Linn., vol. 4, p. 599. 1826.

Type locality.—Not given.

Range.—Widely distributed in the Cordilleran section of North America.

Zone.—Transition and above.

Specimens examined.—Emigrant Gap, Jones, February, 1883; Desolation Valley, west side rising toward Pyramid Peak, 9,100 feet, Smiley 87.

Some of the many forms, in which this very variable species occurs, are given below but it is often quite impossible to satisfactorily assign individual collections, the segregates, subspecies, varieties, and forms, which have been proposed from time to time, merging into each other in all characters.

18a. **Carex Macloviana** var. **gracilis** Kükenth., Pflanzenr., Bd. 4, Heft 20, p. 197. 1909.

Type locality.—Not given.

Range.—Sierra Nevada north into Oregon.

Zone.—Transition and Canadian.

Specimens examined.—Lake Tenaya, Yosemite, 8,300 feet, Hall and Babcock 3639; Gold Lake, Plumas County, 6,400 feet, Hall and Babcock 4497; meadow above Donner Lake, Davy 3236; Tamarack trail, Tahoe, 8,400 feet, Smiley 257.

18b. **Carex Macloviana** var. **stricta** Kükenth., Pflanzenr., Bd. 4, Heft 20, p. 197. 1909.

Type locality.—''California.''

Range.—Pacific Coast.

Zone.—Transition and Canadian.

Specimens examined.—Marlette Lake, Nevada, 8,000 feet, Hall and Chandler 4584; Summit Camp, Kellogg, July, 1870; Brian's meadows, Eldorado County, 9,000 feet, Brainerd 223; near Ebbett's Pass, 9,000 feet, Brewer 2012; Mt. Dana, 11,000 feet, Bolander 5069; Mt. Lyell, McLean, June 7, 1894.

18c. **Carex Macloviana** var. **Haydeniana** Holm, Am. Jour. Sci., vol. 160, p. 286. 1900.

Type locality.—"California."

Range.—California east to Wyoming and Colorado.

Zone.—Hudsonian and above.

Specimens examined.—Mt. Dana, 12,500 feet, Bolander 5074; Tuolumne meadow, 8,600 feet, Smiley 755; Dog Lake, Yosemite, 9240 feet, Smiley 839; Pyramid Peak, Tahoe, 9,100 feet, Smiley 81.

18d. **Carex Macloviana** var. **subfusca** Kükenth., Pflanzenr., Bd. 4, Heft 20, p. 197. 1909.

Type locality.—"Lake Tahoe (*Kellogg*), and near Virginia City, Nevada, *Bloomer.*"

Range.—Southern range of the species.

Zone.—Transition and Canadian.

Specimens examined.—Summit, Kellogg, July 14, 1870; same locality, 7,000 feet, Heller 8841; Truckee River, wet meadows, 7,000 feet, Davy, June 25–30, 1897; Cisco, Kellogg, June 9, 1870.

19. **Carex straminiformis** Bailey, Mem. Torr. Bot. Club, vol. 1, p. 24. 1889.

C. straminea var. *congesta* Olney, Proc. Am. Acad., vol. 7, p. 396. 1868.

Type locality.—Mt. Shasta, California.

Range.—Pacific Coast states.

Zone.—Canadian to Arctic-alpine.

Specimens examined.—Near Ebbett's Pass, on border of a little lake, 8,5–9,000 feet, Brewer 2083; Echo Lake, Eldorado County, Brainerd 197; Pyramid Peak, east side, 9,200 feet, Hall and Chandler 4742; same locality, Brewer 2173; Silver Mountain, 11,000 feet, Brewer 2026; Desolation Valley, Tahoe, 8,500 feet, Smiley 347; Tamarack trail, Tahoe, meadow at 8,400 feet, Smiley 261; Angora Peak, Tahoe, 7,600 feet, Smiley 6b; Mt. Rose, Heller 9903; Carey's Peak, Alpine County, 10,800 feet, Brewer 2125; Lake Tenaya, Yosemite, Congdon, August 17, 1890.

20. **Carex straminea** var. **mixta** Bailey, Proc. Am. Acad., vol. 22, p. 151. 1887.

No specimens of this sedge have been identified with certainty from within our limits and it is here included only because Professor Bailey has referred (*l.c.*) to it certain specimens collected on the State Survey in the higher mountains.

21. **Carex specifica** Bailey, Mem. Torr. Bot. Club, vol. 1, p. 21. 1889.

C. scoparia Schk., var. *fulva* W. Boott, *in* Wats., Bot. Calif., vol. 2, p. 237. 1880.

Type locality.—"California, Silver Valley, head of Tuolumne River, and Ebbett's Pass."

Range.—Pacific Coast in the higher mountains.

Zone.—Transition mainly, rising into the Canadian.

Specimens examined.—Soda Springs, Nevada County, Jones 2448; Slippery Ford, Eldorado County, 6,200 feet, Brainerd 212; head of Tuolumne River, Brewer 1774; Silver Valley, Brewer 1969; near Lily Lake, Tahoe, 6,600 feet, Smiley 397; Yosemite Creek to Porcupine Flat, 7,500 feet, Hall and Babcock 3463; Buck Camp, Mariposa County, 8,000 feet, Congdon, August 12, 1890.

22. **Carex tahoensis**, sp. nov.

Rhizoma caespitosum. Culmus 1.5–3 dm. altus subfirmus triqueter scaber superne foliatus inferne. Folia culmo multo breviora 1 mm. lata complicata rigidula pallida, vaginae inferiores hyalinae. Spiculae 3–4, ovatae gynaecandrae (masculina inferne), densiflorae sessiles collectae, Squamae lanceolatae ovatae castaneosae, cum marginibus albo-hyalinis, 5 mm. longae viridi-carinatae. Utriculi longiores (6 mm. longi) erecti concavo-convexi brunnei nervosi, cum marginibus angustis viridi-alatis et per dimidium superius dense ciliato-scabris, in rostrum longum bidentatum sensim attenuati. Stigmata 2.

(Plant densely caespitose. Culms 1.5–3 dm. high, rather firm and somewhat triangular, roughened above, leafy at the base. Leaves light green, shorter than the culm, rather rigid, 1 mm. broad and closely folded along the midrib, their sheaths hyaline. Spikelets 3–4, ovate, bisexual, male at base, densely flowered, sessile and approximate. Scales 5 mm. long, lanceolate-ovate, castaneous, their margins broadly hyaline and midnerves green. Perigynia 6 mm. long, exceeding their scales, erect, concave-convex, brown in color and nerved on the inner side above the constricted base, their narrow margins green and winged, with the upper halves of the wings densely ciliate-scabrid along the sides of the gradually attenuate bidentate beak. Stigmas 2.)

The species here proposed as new has its nearest allies in *C. Liddonii* Boott and *C. phaeocephala* Piper: from the former it differs in the merely bidentate beak, which in *C. Liddonii* is deeply cleft and in the beak being gradually acuminate, not abruptly rostrate as in Dr. Boott's species. From *C. phaeocephala*, this species may be distinguished by the much longer beak of the perigynium and the oblong ovary, the latter in *C. phaeocephala* being obovate.

Type collected July 19, 1913, on Mt. Tallac, west of Lake Tahoe, at an elevation of about 9,300 feet in the Hudsonian life-zone, *Smiley* 239.

23. **Carex Liddonii** Boott, *in* Hook., Fl. Bor. Am., vol. 2, p. 214, t. 215. 1839.

C. adusta var. *congesta* W. Boott *in* Wats., Bot. Calif., vol. 2, p. 238. 1880.
C. Liddoni Boott var. *incerta* Bailey, Bot. Gaz., vol. 13, p. 89. 1888.

Type locality.—"Columbia River."

Range.—Pacific Coast east to the Rocky Mountains.

Zone.—Transition and Canadian.

Specimens examined.—Dry soil in cañon above Slippery Ford, Eldorado County, 6,500 feet, Brainerd 191½; Truckee River Basin, Placer County, Davy 3266; Soda Springs, Nevada County, 7,000 feet, Jones 2515; Angora Lake, Tahoe, 7,600 feet, Smiley 32.

24. **Carex aurea** Nutt., Gen., vol. 2, p. 205. 1818.

Type locality.—"On the shores of Lake Michigan."

Range.—Newfoundland to British Columbia and south to California, Colorado, Middle States, and southern New England.

Zone.—Transition and Canadian.

Specimens examined.—Glen Alpine, Tahoe, McGregor 21; Suzy Lake, Tahoe, above Glen Alpine, 7,100 feet, Smiley 197; soda springs, Upper Tuolumne River, Bolander 6220; open ground near soda springs, Tuolumne meadows, 8,600 feet, R. A. Ware, 2705c.

25. **Carex nebraskensis** var. **praevia** Bailey, Mem. Torr. Bot. Club, vol. 1, p. 49. 1889.

Type locality.—Not given.

Range.—Sierra Nevada; east to Colorado and northward through Oregon to Washington.

Zone.—Transition, rising into the Canadian.

Specimens examined.—Lower end Donner Lake, Heller 6913; Silver Valley, rather dry places, Brewer 1970; Bonita meadow, Tulare County, Hall and Babcock 5182; Kern River, 9800 feet, Rothrock 371.

26. **Carex rigida** Gooden., Linn. Trans., vol. 2, p. 193. 1794.

Type locality.—Not ascertained.

Range.—In America south to the mountains of Quebec, Rocky Mountains, and Sierra Nevada.

Zone.—Arctic-alpine, rarely in Hudsonian.

Specimens examined.—Mt. Dana, Bolander 5077; Snow Flat, Yosemite, 8,700 feet, Hall and Babcock 3493; Mt. Dana, wet meadow on the north side, 11,800 feet, Smiley 726.

26a. **Carex rigida** var. **hesperia** Piper, Contr. Nat. Herb., vol. 11, p. 173. 1906.

Carex vulgaris var. *bracteosa* Bailey, Proc. Am. Acad., vol. 22, p. 81. 1886, not *C. bracteosa* Schwein.

Type locality.—Ebbett's Pass, California, alt. 8,000 feet.''

Range.—Pacific Coast.

Zone.—Hudsonian?

Specimen examined.—Ebbett's Pass, 8,000 feet, Brewer 2015.

Carex scopulorum Holm (Am. Jour. Sci. IV, vol. 14, p. 422. 1902), a high mountain sedge of Colorado and nearly related to *C. rigida,* is accredited to California by Kukenthal (Pflanzenr., *l.c.,* p. 303), but no specimens from the Sierra have agreed with the description or figures of that species, particularly in the sharply flexed beak to the perigynium.

27. **Carex Goodenowii** J. Gay, Ann. Sci. Nat. II, vol. 11, p. 191. 1839.

Type locality.—Not ascertained.

Range.—Transcontinental at the north, extending southward in the mountains.

Zone.—Hudsonian.

Specimens examined.—Eagle Lake, Tulare County, 10,500 feet, Hall and Babcock 5367; Silver Lake, Brewer 2099; Elizabeth Lake, Tuolumne meadows, 9,800 feet, Smiley 799.

28. **Carex acutina** Bailey, Mem. Torr. Bot. Club, vol. 1, p. 52. 1889.

Type locality.—''Oregon,'' without definite locality, *Howell* 935.

Range.—Pacific Coast east to Colorado.

Zone.—Canadian.

Specimen examined.—Plumas County, Heller and Kennedy 8784; this specimen referred with considerable hesitation as it is too immature for certain determination.

29. **Carex Kelloggii** W. Boott, *in* Wats. Bot. Calif., vol. 2, p. 240. 1880.

Type locality.—''In the Sierra Nevada at Alta and from Lake Tahoe to Bear Valley.''

Range.—Pacific Coast and Idaho.

Zone.—Transition and Canadian (?).

Specimens examined.—Lake Tahoe to Bear Valley, Dr. Kellogg; Meisner's Ranch, by a small lake, 7,600 feet, Brainerd 76.

30. **Carex vesicaria** L., Sp. Pl., p. 979. 1753.

Type locality.—European.

Range.—North temperate zone.

Zone.—Transition mainly rising into the Canadian.

Specimens examined.—Summit, Dr. Kellogg, July 27, (1870?); lower end of Donner Lake, Heller 6938; bog along Strawberry Creek, Eldorado County, 5,900 feet, Brainerd 10, 14; marshy borders of Lake Andrain, Eldorado County, 7,500 feet, Brainerd 12; Ostrander's meadow above Yosemite, Bolander 6211; Lily Lake, Tahoe, 6,600 feet, Smiley 331a; soda springs, head of the Tuolumne River, Brewer 1781; South Fork of the San Joaquin River, 7,600 feet, Hall and Chandler 625.

Some of the above specimens have been referred to the many inconstant varieties of this polymorphous species; in view of what I believe to be the fact—viz., that in any large series of specimens the several named varieties merge inextricably—it has not seemed to me desirable to attempt here their discrimination.

31. **Carex rostrata** Stokes, *in* With. Bot. arr. Brit. Veg., ed. 2, p. 1059. 1787.

C. ampullacea Gooden., Linn. Trans., vol. 2, p. 207. 1794.

Type locality.—"Bogs of Isla, and on Bentelkerny and Breadalbane," England.

Range.—Transcontinental in the north; southward to California, New Mexico, Illinois, Middle States and New England.

Zone.—Transition mainly, but rising into the Canadian.

Specimens examined.—Truckee River, Brewer 2161; Summit, Kellogg; Lily Lake, Tahoe, 6,600 feet, Smiley 387; Lake of the Woods, Tahoe, 8,200 feet, Smiley 49; peat bogs on Meisner's meadow, Eldorado County, 7,600 feet, Brainerd 8; Angora Lake, Tahoe, 7,500 feet, Hall and Chandler 4642; Westfall's meadows, Yosemite, Bolander 4968; Silver Valley, Brewer 1966; Kaweah meadows, in ponds at 9,300 feet, Purpus 5137.

All of the above specimens appear to be referable to the var. *utriculata* (Boott) Bailey.

32. **Carex yosemitana** Bailey, Mem. Torr. Bot. Club, vol. 1, p. 8. 1889.

Type locality.—"California, Yosemite Valley, alt. 6,000 feet."

Range.—Central and southern Sierra Nevada; also in southern California.

Zone.—Transition mainly, but rising in dry rocky stations even to above timber line.

Specimens examined.—Tioga Road above Aspen Valley, Yosemite, 6,700 feet, Smiley 900; Yosemite Valley, Brewer 1636 (co-type); Big Oak Flat Road, Mariposa County, Congdon, June 6, 1896.

33. **Carex lanuginosa** Michx., Fl. N. Am., vol. 2, p. 175. 1803.

Type locality.—"Ad lacus Mistassins," Canada.

Range.—British Columbia to Gulf of St. Lawrence, south to California, New Mexico, Illinois, Pennsylvania, and New Brunswick.

Zone.—Transitian mainly, entering the Canadian.

Specimens examined.—Lower end Donner Lake, Heller 6989; Tallac, 6,200 feet, Brainerd 19½.

34. **Carex Congdoni** Bailey, Bot. Gaz., vol. 21, p. 6. 1896.

Type locality.—"California: Mt. Warren Pass, Tuolumne County, and east side of Mt. Warren, Mono County."

Range.—Central and southern Sierra Nevada.

Specimen examined.—Sawtooth Peak, Tulare County, 11,800 feet, Hall and Babcock 5687.

35. **Carex Buxbaumii** Wahl., Kongl. Vet. Akad. Handl. II, vol. 24, p. 163. 1803.

Type locality.—European.

Range.—In America south from the arctic regions to California, Wyoming, Great Lakes, and Middle States.

Zone.—Canadian?

Specimen examined.—Soda springs, head of the Tuolumne River, 9,700 feet, Bolander 5056.

36. **Carex quadrifida** Bailey, Proc. Calif. Acad. II, vol. 3, p. 104. 1891.

Type locality.—Central Sierra Nevada.

Range.—Sierra Nevada; the type from Mt. Dana.

Zone.—Canadian and Hudsonian.

Specimens examined.—Mt. Rose, 10,000 feet, Heller 9,975; soda springs of the Tuolumne, Congdon, August 18, 1890*; Bloody Cañon, Mono County, 9,500 feet, R. A. Ware 2715c; Lake Tenaya, Congdon, August 19, 1890; near Brown meadow, Tulare County, Hall and Babcock 5160; Yosemite Creek and Indian Cañon to Porcupine Flat, 7,300 feet, Hall and Babcock 3457; mountain near Little Kern River, 10–11,000 feet, Purpus 5238*.

37. **Carex nova** Bailey, Mem. Torr. Bot. Club, vol. 1, p. 10. 1889.

C. atrata var. *nigra* Boott, Ill. Car., vol. 3, p. 114, t. 363. W. Boott, *in* Wats., Bot. Calif., vol. 2, p. 239. 1880.

Type locality.—"Mountains of Wyoming and Colorado and southward."

Range.—California east to Wyoming and New Mexico.

Zone.—Arctic-alpine.

Specimens examined.—Mt. Gibbs, Yosemite, near summit in rocks, 12,200 feet, Smiley 783; Unicorn Peak, Yosemite, 10,400 feet, Smiley 811; Mt. Dana, 12,000 feet, Hall and Babcock 3610; Mt. Goddard, 12,000 feet, Hall and Chandler 674; Wood's Peak, 10,000 feet, Brewer 2122; Kaiser Peak, Fresno County, 10,100 feet, Smiley 640.

Professor Bailey identified *Coville and Funston* 2073 from above timber line on Mt. Whitney with this species.

38. **Carex atrata** var. **discolor** Bailey, Lond. Jour. Bot., vol. 26, p. 321. 1888.

Type locality.—"Mountains of Colorado and Utah and southward."

Range.—Mountains of western United States.

Specimen examined.—High mountain near Donner Pass, Torrey 549.

39. **Carex Whitneyi** Olney, Proc. Am. Acad., vol. 7, p. 394. 1868.

Type locality.—"Yosemite Valley."

Range.—Sierra Nevada; mountains of northern California.

Zone.—Canadian.

Specimens examined.—Donner Lake, Heller 6941; Meisner's Ranch, Eldorado County, 7,600 feet, Brainerd 123; soda springs, Tuolumne River, Brewer 1778; Tuolumne meadows, open dry gravel slope, 8,600 feet, R. A. Ware 2706c.

40. **Carex Rossii** Boott, *in* Hook., Fl. Bor. Am., vol. 2, p. 222. 1840.

C. novae-angliae var. *Rossii* Bailey, Bot. Gaz., vol. 10, p. 207. 1885.

C. deflexa var. *Rossii* and var. *media* Bailey, Mem. Torr. Bot. Club, vol. 1, p. 43. 1889.

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* These specimens belong to the high mountain dwarf form described as the var. *lenis* Bailey (*l.c.*), which is connected to the typical form of stouter habit by numerous intergrades.

C. Novae-angliae var. *deflexa* Bailey, Proc. Am. Acad., vol. 22, p. 124. 1886.
C. deflexa var. *Farwellii* Brit., *in* Brit. and Brown, Ill. Fl., vol. 1, p. 334. 1896.
C. Farwellii Mackenzie, Bull. Torr. Bot. Club, vol. 37, p. 244. 1910.

Type locality.—"N.W. Coast, *Douglas;* Rocky Mountains, *Drummond.*"

Range.—British Columbia east to mountains of Alberta, south in the Rockies and Sierra-Cascades to California and Colorado. Acc. Mackenzie (Bull. Torr. Bot. Club., vol. 40, p. 541) this is also present in northern Michigan.

Zone.—Canadian.

Specimens examined.—Sierra Nevada, Kellogg; Summit, Heller 9853; Pyramid Peak, Tahoe, Hall and Chandler 4749; Tuolumne meadows, gravelly loam of pine forest, 8,600 feet, R. A. Ware 2721c.

41. **Carex luzulaefolia** W. Boott *in* Wats., Bot. Calif., vol. 2, p. 250. 1880.

Type locality.—"In the Sierra Nevada, at high altitudes, from above Yosemite Valley to Ebbett's Pass and northward."

Range.—Sierra Nevada.

Zone.—Hudsonian.

Specimens examined.—Tamarack trail, Tahoe, meadow at 8,400 feet, Smiley 268; Pyramid Peak, 8,800 feet, Hall and Chandler 4747; Devil's Basin, Eldorado County, 8,000 feet, Brainerd 28; Mt. Tallac, 9,000 feet, Abrams 4850; Suzy Lake, Tahoe, McGregor 102; above Ebbett's Pass near lake, Brewer 2019; soda springs, Yosemite, 10,000 feet, Brewer 1701; Wood's Peak, wet places, Brewer 2131.

41a. **Carex luzulaefolia** var. **ablata** Kükenth., Pflanzenr., Bd. 4, Heft 20, p. 558. 1909.

C. ablata Bailey, Bot. Gaz., vol. 13, p. 82. 1888.

Type locality.—Not given.

Range.—British Columbia to California and east to Utah.

Zone.—Same as the species.

Specimen examined.—Strawberry Creek, bog at 5,900 feet, Eldorado County, Brainerd 30.

This variety is said by Parish (So. Calif. Acad. Sci., Prelim. Synop.) to have been collected on Mt. Grayback at 9,500 feet, by *G. B. Grant* 6405.

41b. **Carex luzulaefolia** var. **strobilantha** Holm, Am. Jour. Sci. IV, vol. 20, p. 305. 1905.

Type locality.—"California: above Donner Pass in Placer county in a sub-alpine meadow, where snow drifts lie late, and usually near granite rocks."

Range.—So far known only from the original station.

Specimen examined.—Above Donner Pass, Heller 7187.

42. **Carex Raynoldsii** Dewey, Am. Jour. Sci. II, vol. 32, p. 39. 1861.

C. Lyallii Boott, Ill. Car., vol. 1, p. 150, t. 483. 1858.

Type locality.—"Pierre's Hole, Snake River Valley, alt. 6,000 ft."

Range.—Mountains of western North America south from British Columbia to California, Utah, and Colorado.

Zone.—Canadian and Hudsonian.

Specimens examined.—Silver Valley, dry hillsides, 8,000 feet, Brewer 1968; Meisner's Ranch, Eldorado County, 7,600 feet, Brainerd 81; Tamarack trail, Tahoe, 8,400 feet, Smiley 256; Old Tioga Road, Yosemite, dry pine forest, 8,400 feet, R. A. Ware 2717c; Mt. Dana, 10,000 feet, Bolander 5088; Lake Tenaya, dry places, Brewer 1690; Lake Tenaya, 8,300 feet, Hall and Babcock 3645; same locality, 8,200 feet, Smiley 864; Tuolumne meadows, gravelly loam in pine forest, 8,600 feet, R. A. Ware 2720c.

43. **Carex limosa** L., Sp. Pl., p. 977, 1753.

Type locality.—European.

Range.—Arctic America south to California, Montana, Ohio, and New Jersey.

Zone.—Canadian, occurring in peat bogs.

Specimen examined.—Bog hole near Lake Andrian, Eldorado County, 7,500 feet, Brainerd 22.

44. **Carex invisa** Bailey, Proc. Am. Acad., vol. 22, p. 82. 1887.

C. podocarpa W. Boott, *in* Wats., Bot. Calif., vol. 2, p. 245. 1880, not of R. Br.

Type locality.—"Summit Camp, *Kellogg,* the type growing in exceedingly tough and matted clumps."

Range.—Sierra Nevada, northward to Mt. Lassen and (acc. Bailey, *l.c.*) to the Selkirks of British Columbia.

Zone.—Transition and Canadian.

Specimens examined.—Above Suzy Lake, Tahoe, 8,000 feet, Smiley 198; Lake Lucile, Tahoe, Hall and Chandler 4656; Carson Pass, Brewer 2136; Summit Camp, Kellogg; foot of Mt. Dana, Congdon, August 10, 1898; Nellie Lake, meadow, 8,700 feet, Smiley 600.

Other Carex species are not infrequently collected within our borders but their zones of greatest frequency are below our limits.

Since the above treatment of this difficult genus was completed, Mr. K. K. Makenzie has published a paper on the ''Californian Representatives of the Ovales'' (Bull. Torr. Bot. Club, vol. 43, pp. 601–620. 1916), wherein a number of new species are proposed and certain specimens cited which, in the treatment here presented, are otherwise referred.

12. JUNCACEAE (Rush Family)

Leaves soft and flat, their sheaths closed; stems hollow; capsule 1-celled and 3-seeded; plants more or less villous .... 1. **Luzula**
Leaves stiff, terete or flat, their sheaths open; stems usually filled with spongy pith; capsule 3-celled and many seeded; plants never villous .... 2. **Juncus**

1. LUZULA

Inflorescence an open cyme.
  Pedicels short, the flowers in somewhat fascicular clusters; leaves lance-linear to lanceolate .... 1. **L. parviflora**
  Pedicels elongated, the flowers solitary; leaves linear .... 2. **L. divaricata**
Inflorescence spicate or glomerate.
  The inflorescence nodding, usually a single spike; leaves channeled .... 3. **L. spicata**
  The inflorescence erect, of 2 or more subglobose or oblong clusters .... 4. **L. campestris**

1. **Luzula parviflora** var. **subcongesta** Buchenau, Monogr. Juncac., p. 110. 1890.

L. spadicea var. *subcongesta* Wats. Bot. Calif., vol. 2, p. 202. 1880.

Type locality.—''In the Sierra Nevada, near Donner Lake.'' Torrey.

Range.—California northward and eastward to Washington and Utah?

Zone.—Canadian.

Specimens examined.—High mountain near Donner Pass, Torrey 541; above Donner Pass, 7,500 feet, Heller 7135; near Donner Lake, E. L. Greene 454; Tioga Road near Dark Hole, Yosemite, 7,700 feet, Smiley 877; Yosemite Creek, 7,300 feet, Hall and Babcock 3458; Tioga Road, dry pine forest, 8,400 feet, R. A. Ware 2719c.

2. **Luzula divaricata** Wats., Proc. Am. Acad., vol. 14, p. 302. 1879.

Type locality.—"In the Sierra Nevada, mostly alpine from above Mono Lake to Sierra County."

Range.—Sierra Nevada, central and southern portions.

Zone.—Transition to Hudsonian.

Specimens examined.—Carson Spur, Alpine County, 8,500 feet, Hansen 815; Heather Lake, Tahoe, 7,800 feet, McGregor 182, 186; ridge south of Donner Pass, 7,500 feet, Heller 7138; Suzy Lake, Tahoe, 7,900 feet, Smiley 153; above Summit Station, 8,500 feet, E. L. Greene 400; near Castle Peak, Lemmon in 1873; Ebbett's Pass, Brewer 2069; peak above Mono Lake, 10,000 feet, Brewer 1794; Mt. Rose, 10,000 feet, Kennedy 1155; rocky mountain slopes along Little Kern River, Tulare County, 11–12,000 feet, Purpus 5248; Sawtooth Peak, 11,000 feet, Hall and Babcock 5690; near Mineral King, Coville and Funston 1542.

5. **Luzula spicata** var. **nova**, n. var.

Differt a forma typica cum capsula segmentis perianthii sit semper brevior.

This variety, which appears to be strictly west American, is distinguished from the species by the mature capsule being always shorter than the segments of the perianth and usually only one-half as long. In the species, the mature capsule is exserted from the perianth.

While the variety here distinguished has, so far as known, no other character unlike those of the species, its consistent exhibition of the critical character throughout its definite range seems sufficient warrant for its proposal. The specimen in which the distinction was first recognized is *Coville and Funston* 1535 as represented in the Gray Herbarium and this may be regarded as the type sheet.

Range.—Cordilleran section of the United States, northward to British Columbia.

Zone.—Arctic-alpine.

Specimens examined.—Sierra Nevada near Mineral King, Tulare County, Coville and Funston 1535; mountains near Little Kern River, Tulare County, growing in rocky places, Purpus 5249; Mt. Dana, 12,200 feet, Smiley 729.

4. **Luzula campestris** var. **congesta** (Thuill.) Meyer, Syn. Luz., p. 18. 1823.

Juncus congestus Thuill., Fl. Par., ed. 2, p. 179. 1799.
Luzula comosa var. *congesta* Wats., Bot. Calif., vol. 2, p. 203. 1880.
Juncoides comosum var. *congestum* Howell, Fl. N.W. Am., vol. 1, p. 681. 1905.

Range.—In North America in the mountains of the Cordilleran section and of the Pacific Coast.

Specimens examined.—Meadows near Black Mountain, Fresno County, 10,000 feet, Hall and Chandler 607; Elizabeth Lake, Yosemite, 9,800 feet, Smiley 791.

Coville and Funston 1553, from timber line near Mineral King, Tulare County, has been referred to this variety,[50] but the specimen is possibly too immature for certain determination.

4b. **Luzula campestris** var. **multiflora** (Ehrh.) Celak., Prodr. Fl. Bohm., p. 85. 1869.

Range.—British Columbia to Newfoundland and south to California, Wyoming, Great Lakes, and Middle States.

Specimen examined.—High mountain near Donner Pass, Torrey 542.

4c. **Luzula campestris** var. **comosa** (Meyer) Fernald and Wiegand, Rhodora, vol. 15, p. 41. 1913.

L. comosa var. *subsessilis* Watson, Bot. Calif., vol. 2, p. 203. 1880.

Range.—In America from the subarctic regions south in the east to Quebec; in the west to mountains of southern California.

Specimens examined.—Above Lake Tenaya, margin of a stream, 8,400 feet, Smiley 862; Elizabeth Lake, Yosemite, meadow at 9,800 feet, Smiley 792.

2. JUNCUS

Dwarf annual, 1–2 inches high ....1. **J. triformis**
Perennials.
  Stems naked, terete, sheathed at base; leaves terete or none; panicle lateral and sessile; flowers few (1–4); low, high montane plants.
    Stems very slender, 1 foot or less high with inner sheaths bristle-tipped; spathe ½–1 inch long, about equalling the panicle; anthers subequal to the filaments or a little longer; capsule retuse, included by the sepals ....2. **J. Drummondii**
    Stems filiform and wiry, 3–6 inches high with inner sheaths leaf bearing; spathe exceeding the inflorescence; anthers much longer than the filaments; capsule acute, exserted from the sepals ....3. **J. Parryi**

Stems leafy; inflorescence terminal.
  Leaves not nodulose, flat and grass-like, neither equitant nor ligulate; flowers capitate or clustered.
    Stems low, mostly equalling the leaves or shorter ....4. **J. obtusatus**
    Stems taller, exceeding the leaves ....5. **J. orthophyllus**
  Leaves nodulose, compressed or flattened laterally and equitant, ligulate.
    Leaves lightly compressed, subterete, without auricles and very narrow; stems ½–2 feet high, very slender; heads usually many ....6. **J. nevadensis**
    Leaves obviously flattened laterally and equitant, auricled.
      Perianth segments pale and scarious, often obtuse; heads 1 or 2. ....7. **J. chlorocephalus**
      Perianth segments dark brown or purplish and usually acute.
        Heads solitary, many flowered; stamens 6 ....8. **J. Mertensianus**
        Heads 5 or 3, fewer flowered; stamens 3 ....9. **J. ensifolius**

1. **Juncus triformis** var. **uniflorus** Engelm., Trans. St. Louis Acad., vol. 2, p. 493. 1868.

J. uncialis Greene, Pitt., vol. 2, p. 105. 1890.

Type locality.—"Sierra Nevada among mosses."

Range.—Washington to southern California, east to eastern Nevada.

Zone.—Transition and Canadian.

Specimens examined.—Near Camp Agassiz above Fallen Leaf Lake, Tahoe, 6,700 feet, Smiley 363a; Tuolumne meadows, sandy places on the meadows, 8,500 feet, Smiley 739; Upper Tuolumne, Bolander.

Parish identifies *Reed* 2481^{98} from Lake Surprise, 9,000 feet, San Jacinto Mountains, as of this species; this is the present known southern limit of its range.

J. uncialis Greene was described from "Low moist places in fields near Suisun, California."

2. **Juncus Drummondii** E. Meyer, *in* Ledeb., Fl. Ross., vol. 4, p. 235. 1853.

J. subtriflorus (Mey.) Coville, Contr. Nat. Herb., vol. 4, p. 208. 1893.
J. compressus var. *subtriflorus* Meyer, Linnaea, vol. 3, p. 368. 1828.

Type locality.—"Unalaschka."

Range.—Alaska to California and New Mexico. Eurasia.

Zone.—Hudsonian and Arctic-alpine.

Specimens examined.—Tamarack trail, meadow at 8,400 feet, Tahoe, Smiley 260; above Donner Pass, 7,500 feet, Heller 7134; Dana Fork meadows, Yosemite, 9,750 feet, Smiley 848; Mono trail, 9–10,000 feet, Bolander, August, 1866; Bloody Cañon, Mono County, 9,500 feet, R. A. Ware 27.16c; Shuteye Mountain, Madera County, on a north facing slope, 8,100 feet, Smiley 568; same locality, rocks on north side of peak in granite, 8,000 feet, J. Murdoch 2561; slope above

Nellie Lake, Fresno County, 9,000 feet, Smiley 613; Tulare County, Coville and Funston 1563.

The very dwarf var. *humilis* Engelm. (Trans. St. Louis Acad., vol. 2, p. 445. 1866) described from Mt. Shasta, is not known from the Sierra. Buchenau (Pflanzeur., Bd. 4, Heft 36, p. 143) considers it a mere depauperate form—"Vix varietas, sed forma parva."

3. **Juncus Parryi** Engelm., Trans. St. Louis Acad., vol. 2, p. 446. 1866.

Type locality.—"On the western and north-western mountains" (described from Colorado specimens).

Range.—Southern Alaska (Juneau) to mountains of southern California and in the Rockies to Colorado.

Zone.—Arctic-alpine, sometimes in Hudsonian.

Specimens examined.—High mountain near Donner Pass, Torrey 536; Bierstadt Peak, Tahoe, Davy 3220; Pyramid Peak at summit, Tahoe, 10,020 feet and at 9,600 feet, Hall and Chandler 4717; Desolation Valley, Tahoe, 8,500 feet, Smiley 339; Elizabeth Lake, Yosemite, rocky ravine south of the meadow, 9,900 feet, Smiley 805; Black Mountain, meadows, Fresno County, 10,000 feet, Hall and Chandler 608; Sawtooth Peak, Tulare County, 11,000 feet, Hall and Babcock 5689; basin of Upper Kern River near Langley's Camp, 11,800 feet, Hall and Babcock 5544.

Parish[99] reports this as having been collected on the summit of Mt. Grayback, San Bernardino Mountains, at 11,485 feet, the southern limit so far as known.

4. **Juncus obtusatus** Engelm., Trans. St. Louis Acad., vol. 2, p. 495. 1868.

Type locality.—"Near the Big Tree Grove, Mariposa, California, growing in large tufts, 2–3 feet in diameter on the sandy banks of the streamlets, alt. 6,500 feet." *Bolander.*

Range.—Sierran region, perhaps in the mountains of southern California.

Zone.—Transition, entering Canadian.

Specimens examined.—Near Big Tree Grove, Bolander; Sierra Buttes, 6,000 feet, at Lower Sardine Lake, Hall and Babcock 4489, doubtfully referred; Yosemite, J. Muir in 1875; Porcupine Flat, Yosemite, 8,000 feet, R. A. Ware 2735c; soda springs of Tuolumne, Congdon, August 15, 1894; Little Yosemite, on Merced River, 6,700 feet, R. A. Ware 2708c.

5. **Juncus orthophyllus** Coville, Contr. Nat. Herb., vol. 4, p. 207. 1893.

J. longistylis var.? *latifolius* Englem., Trans. St. Louis Acad., vol. 2, p. 496. 1868.

J. latifolius Buchenau, Monogr. Juncac., p. 425. 1890.

Type locality.—"Californian Sierras on alpine meadows or along rivulets in the Yosemite Valley alt. 4000 feet, Hb. n. 46; on the upper Tuolumne, alt. 10,000 feet, and frequent on the eastern slope of the mountains."

Range.—Sierra Nevada northward to British Columbia.

Zone.—Transition and Canadian.

No specimens of this rush have been seen by me; Coville (*l.c.*) found a rush growing on Whitney meadows, Tulare County, which he referred to this species; it formed a conspicuous part of the meadow vegetation.

6. **Juncus nevadensis** Wats., Proc. Am. Acad., vol. 14, p. 303. 1879.

J. phaeocephalus var. *gracilis* Engelm., Trans. St. Louis Acad., vol. 2, p. 209. 1868.

Type locality.—"Frequent in the Sierra Nevada, from Kern County (Rothrock) to Oregon."

Range.—Sierra Nevada and southern Cascades.

Zone.—Canadian.

Specimens examined.—Independence Lake, Sierra County, 7,500 feet, Hall and Babcock 4541; Lake Tahoe to Bear Valley, Bolander, Kellogg and Co. in 1866; high mountain near Donner Pass, Torrey 535; Pyramid Peak, Tahoe, 9,500 feet, Smiley 114; Tamarack trail, Tahoe, 8,400 feet, Smiley 259; Castle Peak, Tahoe, 8,200 feet, Smiley 471; Crescent Lake, Mariposa County, Congdon, August 10, 1890; Snow Flat, Yosemite, 8,700 feet, Hall and Babcock 3492; Tuolumne meadows, open ground at 8,600 feet, R. A. Ware 2724c; between Lake Tenaya and Tuolumne meadows, 8,700 feet, Smiley 705; Hockett's meadows, Tulare County, 8,500 feet, Hall and Babcock 5617; near Whitney meadows, Coville and Funston 1721; Kern River, 9,800 feet, Rothrock 382.

7. **Juncus chlorocephalus** Engelm., Trans. St. Louis Acad., vol. 2, p. 485. 1868.

Type locality.—"In the higher mountains of California."

Range.—Sierra Nevada.

Zone.—Canadian and Hudsonian.

Specimens examined.—Above Donner Pass, 8,000 feet, Heller 7118; Silver Lake, Amador County, 8,000 feet, Hansen 596; meadow near Fallen Leaf Lake, Miss Lathrop, July 12, 1909; Fallen Leaf, 6,400 feet, Hall 8776; between Suzy and Heather Lakes, Tahoe, 8,800 feet, Smiley 286; Glen Alpine, Tahoe, McGregor 23; Ebbett's Pass, Brewer 1992; vicinity Lake Tenaya, 8,200 feet, Hall and Babcock 3636; near Mt. Dana, dry places, 10,000 feet, Brewer 1804; Lake Tenaya trail, Yosemite, Congdon, August 13–14, 1894; Tioga Road, Yosemite, near White Wolf, 8,200 feet, Smiley 88.

8. **Juncus Mertensianus** Bong., Mem. Acad. St. Petersb. VI, vol. 2, p. 167. 1833.

Type locality.—Sitka.

Range.—Unalaska to California and Colorado.

Zone.—Canadian and Hudsonian.

Specimens examined.—Desolation Valley, Tahoe, 8,500 feet, Smiley 346; Pyramid Peak, 9,100 feet, Smiley 80; Lake of the Woods, Tahoe, meadow at 8,200 feet, Smiley 51; east side of Mt. Rose, 8,450 feet, Heller 10946a; Mono Pass, Bolander, September, 1866; Mt. Dana, Congdon, August 10, 1898.

9. **Juncus ensifolius** Wiks., Congl. Vet. Akad. Handl., vol. 2, p. 274. 1823.

J. xiphioides var. *triandrus* Engelm., Trans. St. Louis Acad., vol. 2, p. 482. 1868.

J. xiphioides var. *macranthus* Engelm., *l.c.*

Type locality.—Not ascertained.

Range.—Pacific Coast from southern Alaska to California in the Cascade and Sierra Nevada.

Zone.—Transition and Canadian.

Specimens examined.—Shores of Heather Lake, Tahoe, 7,900 feet, Smiley 278.

Juncus balticus var. *montanus* Engelm. (Trans. St. Louis Acad., vol. 2, p. 446. 1866), a dwarf variety of the common lowland species and itself mainly of the Transition zone, has been collected in the higher mountains: Coville reports what is probably this variety from Whitney meadows, Tulare County, at 3,000 m. (Contr. Nat. Herb., vol. 4, p. 204. 1893).

13. LILIACEAE (Lily Family)

Leaves mainly or entirely radical, the stems being scapes or scapose.
Style 1, sometimes trifid at the summit.
Flowers with scarious bracts and persistent perianth.
Flowers in terminal umbels.
Perianth segments united at base into a tube; plants with corms .... 1. **Brodiaea**
Perianth segments distinctly inserted on the receptable; plants with tunicated bulbs .... 2. **Allium**
Flowers in a terminal raceme .... 3. **Camassia**
Flowers bractless or the bracts foliaceous and perianth caducous.
Perianth segments of two sorts, the outer smaller and foliaceous .... 4. **Calochortus**
Perianth segments all alike.
Filaments naked .... 5. **Erythronium**
Filaments with dense yellow wool .... 6. **Narthecium**
Styles 3, distinct to the ovary.
Stem glandular-pubescent rising from a rootstock .... 7. **Tofieldia**
Stems glabrous, from a tunicated bulb .... 8. **Zygadenus**
Plants with well developed cauline leaves (the uppermost in *Xerophyllum* reduced to bracts).
Leaves 2-ranked; fruit a berry .... 9. **Smilacina**
Leaves whorled or in spirals; fruit a capsule.
Styles distinct.
Leaves broad, entire, not rigid .... 10. **Veratrum**
Leaves narrowly linear, serrulate, and rigid .... 11. **Xerophyllum**
Styles united (i.e. simple).
Nectary a shallow pit; flowers purplish-mottled .... 12. **Fritillaria**
Nectary a linear groove; flowers white or orange .... 13. **Lilium**

1. BRODIAEA

Filaments broadened at base, their form deltoid .... 1. **B. ixioides**
Filaments filiform .... 2. **B. gracilis**

1. **Brodiaea ixioides** Wats., Proc. Am. Acad., vol. 14, p. 238. 1879.

Ornithogalum ixioides Ait., Hort. Kew., vol. 2, p. 257. 1789.

Calliprora lutea Lindl., Bot. Reg., t. 1590. 1833. Hook., Bot. Mag., t. 3588. 1837.

Calliprora aurantea Kellogg, Proc. Calif. Acad., vol. 2, p. 20. 1860?

Type locality.—Not ascertained.

Range.—Southern California northward through the Sierra to Oregon. Washington?

Zone.—Transition and Canadian.

Specimens examined.—Grass Lake, Tahoe, McGregor 8; Glen Alpine, Miss Lathrop, July 19, 1909; Desolation Valley, Tahoe, 8,500 feet, Smiley 113; between Lake Tenaya and Tuolumne meadows in moist pine forest, 8,800 feet, R. A. Ware 2665c; near Lake Tenaya, 8,300 feet, Hall and Babcock 3522; woods near Lake Tenaya, 8,200 feet, Smiley 693; below Suzy Lake, Tahoe, 7,500 feet, Smiley 176; high mountain near Donner Pass, Torrey 517a; Peregoy's, above

Yosemite, A. Gray in 1872 (a doubtful form and perhaps better referred to the following variety); Kaweah meadows, Tulare County, open woods, 9,300 feet, Purpus 5139; Hockett's meadows, Tulare County, Culbertson (B 4429).

1a. **Brodiaea ixioides** var. **scabra** (Greene), comb. nov.

Calliprora scabra Greene, Erythea, vol. 3, p. 126. 1895.

Type locality.—Not given.

Range.—Same as the species.

Zone.—Canadian.

Specimens examined.—Long Lake, Plumas County, 6,800 feet, Hall 9350; Pyramid Peak, glacial valley on east side, 8,800 feet, Smiley 98; Desolation Valley, 8,400 feet, Smiley 348; Gilmore's Lake, Tallac, C. J. Fox Jr., July, 1895; base of Mt. Hoffman, Yosemite (collector not given); soda springs of the Tuolumne, 9,000 feet, Brewer 1775; between Lake Tenaya and Tuolumne meadows, 8,500 feet, Smiley 707; Lake Tenaya, 8,100 feet, Smiley 689.

This variety commonly grows at slightly higher levels than is normal for the species, though occasionally both forms will be found growing together.

2. **Brodiaea gracilis** Wats., Proc. Am. Acad., vol. 14, p. 238. 1879.

Type locality.—"On Spanish Peak, Plumas County." Mrs. R. M. Austin.

Range.—Sierra Nevada.

Zone.—Canadian.

Specimens examined.—Desolation Valley, Dudley, June 26, 1900; near Gold Lake, Plumas County, near the base of Spanish Peak, Mrs. R. M. Austin in 1877; vicinity of Lake Tenaya, 8,300 feet, Hall and Babcock 3523.

2. ALLIUM

Stamens shorter than the perianth segments and included by them; scape terete.
Capsule not crested.
Bracts 3; leaves usually 2 .... 1. **A. tribracteatum**
Bracts 2; leaf solitary .... 2. **A. ambiguum**
Capsule conspicuously crested; leaves several.
Filaments broadened at the base .... 3. **A. bisceptrum**
Filaments filiform .... 4. **A. campanulatum**
Stamens longer than the perianth segments and exserted.
Scape very stout, somewhat angled, 1–3 feet high .... 5. **A. validum**
Scape very slender, much compressed and 2-edged, 3–5 inches high .... 6. **A. platycaule**

1. **Allium tribracteatum** Torr., *in* Pac. R.R. Rep., vol. 4, p. 148. 1857.

Type locality.—"Hillsides, Duffield's Ranch, Sierra Nevada."

Range.—Central Sierra, Mono County to Plumas County; also in Tulare County.

Zone.—Canadian and above.

Specimens examined.—Cisco, 9,000 feet, Bolander in 1872; trail to Mt. Tallac above Glen Alpine, 7,200 feet, Reed and Pendleton 1650; peak above Mono Lake, 10,000 feet, Brewer 1799; Mt. Surprise, Mariposa County, Congdon, August 11, 1890; Dana Fork meadows, Yosemite, 9,800 feet, Smiley 855.

The extension of the range to Tulare County is not based upon specimens seen by me but is founded upon Coville's statement[50] that *Coville and Funston* 1543 is of this species.

2. **Allium ambiguum** Jones, Contr. W. Coast Bot., vol. 10, p. 18. 1902.

Type locality.—"Growing on alpine ridges at Summit, Calif."

Range.—Mountains of Modoc County southward through the Sierra, perhaps to southern California.

Zone.—Canadian.

Specimens examined.—Near Summit, Jones 6660 (type collection); shoulder of Mt. Ralston, Tahoe, 8,000 feet, Setchell and Dobie, July, 1901; Cisco, Placer County, A. R. Valentin, June, 1914; summit between Lake Lucile and Lake of the Woods, Tahoe, M. S. Baker, July 17, 1904.

3. **Allium bisceptrum** Wats., Bot. King's Exped., p. 351, t. 37. 1871.

Type locality.—"On stream banks in the mountains, from the Trinity to the East Humboldt Ranges, Nevada, and in the Wahsatch; 6–7,500 feet altitude."

Range.—Sierra Nevada to Utah.

Zone.—Arid Transition and rising into the Canadian.

Specimens examined.—Sierra Nevada, 9,000 feet, E. L. Greene 387; Crescent Lake, Mariposa County, Congdon, August 13, 1895.

4. **Allium campanulatum** Wats., Proc. Am. Acad., vol. 14, p. 231. 1879.

Type locality.—"Sierra Nevada (Mariposa to Plumas Counties: n. 4943 Bolander; Mrs. M. E. P. Ames)."

Range.—Sierra to Mt. Shasta and on the inner side of the North Coast Ranges (Tehama County).

Zone.—Arid Transition and Canadian.

Specimens examined.—Plumas County, Mrs. Ames in 1875; ridge south of Donner Pass, 8,500 feet, Heller 7155; Lake of the Woods, Tahoe, 7,850 feet, McGregor 42; Mt. Elwell, Plumas County, 6,900 feet, Hall 9338*; Angora Peak, Tahoe, 7,600 feet, Smiley 13*; Mt. Bullion, Mariposa County, Bolander 4943; Gravelly slopes near Lake Lucile, Tahoe, 8,500 feet, Hall and Chandler 4667; Cascade Mountains, Tahoe, Setchell and Dobie, July 6–21, 1901*; near Marlette Peak, east side Lake Tahoe, 8,000 feet, Hall and Chandler 4590*; Tuolumne meadows, 8,500 feet, Smiley 709; Alta meadows, Tulare County, 9,000 feet, Mrs. Brandegee, August 4, 1905.

Dr. H. M. Hall has pointed out (Univ. Calif. Publ. Bot., vol. 4, p. 196. 1912) some of the numerous intergrades between typical *A. campanulatum* and the dwarf form of the higher mountains, which was described by Watson as *A. Bidwelliae* (*l.c.*) and has shown that it is impossible to maintain the latter species distinct. Among the specimens cited above, those marked * are of the dwarf form.

5. **Allium validum** Wats., Bot. King's Exped., p. 350. 1871.

Type locality.—"From Mono Pass."

Range.—California to Washington and Idaho, east to the ranges of eastern Nevada.

Zone.—Canadian.

Specimens examined.—Sierra County, Lemmon 683; Silver Lake, Amador County, 7,200 feet, E. Mulliken 139; Grass Lake, Tahoe, 7,200 feet, McGregor 95; Marshy ravine near Fallen Leaf Lake, Tahoe, 6,700 feet, Smiley 315; above Mono trail, Bolander 6248 (type); saddle between Mt. Dana and Mt. Gibbs, Chesnut and Drew, July 17, 1889; South Fork of San Joaquin, 9,000 feet, Hall and Chandler 655; Coyote Creek, Tulare County, Culbertson (B 4363); Mineral King, Brandegee, July 27, 1892; Mt. Brewer, Brewer 2824; Hockett meadows, Tulare County, 8,500 feet, Hall and Babcock 5621; Alta meadows, 10,000 feet, Tulare County, Mrs. Brandegee, August 6, 1905.

6. **Allium platycaule** Wats., Proc. Am. Acad., vol. 14, p. 234. 1879.

Type locality.—"Sierra Nevada (high valleys, Placer to Plumas Counties)."

Range.—Northern Sierra Nevada.

Zone.—Canadian.

Specimens examined.—Bear Valley, 8,000 feet, Bolander in 1873; Sierra Valley, Lemmon in 1873; Soda Springs, Nevada County, close to snow among rocks, Jones; ridge east of Red Clover Valley, Heller and Kennedy 723; near Squaw Peak, Placer County, C. J. Fox Jr., July, 1895.

Allium obtusum Lemmon, Pitt., vol. 2, p. 69. 1890, said to be near *A. nevadense* Wats. and *A. tribracteatum* Torr. and described as being "Rare in the subalpine region of Gold Lake, Plumas County," where the type was collected by *Lemmon,* June 26, 1889, is unknown to me nor have I been able to find any specimens referable to it by character.

The statement made by Professor M. E. Jones (Contr. W. Coast Bot., vol. 10, p. 8. 1902) that *A. haematochiton* Wats. grows at Soda Springs, Nevada County, a station within our region, is certainly an error; this species is only known from the southern Coast Ranges (Ojai Valley) and southern California.

3. CAMASSIA

1. **Camassia quamash** (Pursh.) Coville, Proc. Biol. Soc. Wash., vol. 11, p. 64. 1897.

Phalangium quamash Pursh., Fl., vol. 1, p. 226. 1914.
Camassia esculenta Lindl., Bot. Reg., vol. 18, t. 1486. 1832.

Type locality.—Near Weippe, Idaho.

Range.—British Columbia to Montana, south to California and Utah.

Zone.—Transition, entering the Canadian.

Specimens examined.—Webber Lake, Kennedy and Doten 149; bog in Little Yosemite Valley, 6,300 feet, Hall 9047.

4. CALOCHORTUS

Leaf solitary, flat, much exceeding the scape; anthers mucronate at the tip, scarcely sagittate at base .... 1. C. nudus
Leaves 2–several, narrow, revolute, shorter than the scape; anthers sagittate at base .... 2. C. Nuttallii

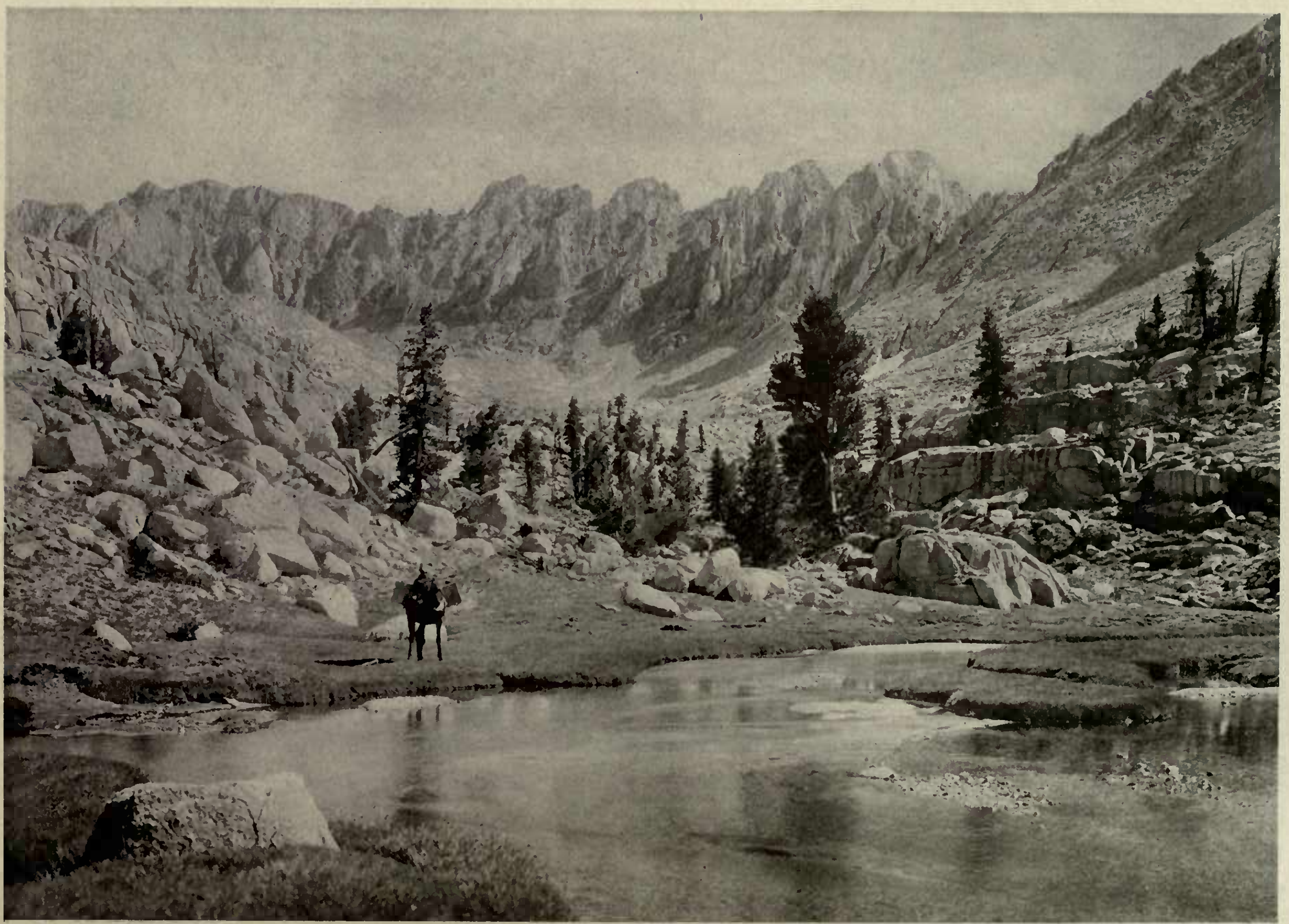
1. **Calochortus nudus** Wats., Proc. Am. Acad., vol. 14, p. 263. 1879.

C. elegans var. *subclavatus* Baker, Jour. Linn. Soc. (Bot.), vol. 14, p. 305. 1875.

Type locality.—"California (in the Sierra Nevada, Yosemite Valley to Plumas County; n. 1986, Hartweg)."

Range.—Mt. Shasta to Tulare County through the Sierra.

Zone.—Upper Transition and Canadian.



TIMBER LINE, MT. WHITNEY REGION, SOUTHERN SIERRAS, TULARE COUNTY.

Specimens examined.—Plumas County, Mrs. R. M. Austin in 1876; Glen Alpine, Setchell and Dobie, July 6–21, 1901; Lake of the Woods, Tahoe, 8,100 feet, Smiley 58; Desolation Valley, 7,500 feet, McGregor 163; Duffield's Ranch, Bigelow; Meadow back of Glacier Point, Yosemite, A. Graef in 1872; Hockett meadows, Tulare County, 8,500 feet, in grass beneath pines, Hall and Chandler 4754; Tioga Road, Yosemite, marshy meadow near Aspen Valley, 6,400 feet, Smiley 908.

2. **Calochortus Nuttallii** var. **Leichtlinii** (Hook.), comb. nov.

C. Leichtlinii Hook., Bot. Mag., vol. 96, t. 5862. 1870.
C. Nuttallii var. *subalpinus* Jones, Contr. W. Coast Bot., vol. 12, p. 78. 1908.

Type locality.—"In the Sierra Nevada of California."

Range.—Sierra Nevada.

Zone.—Canadian.

Specimens examined.—Jameson Creek, Plumas County, 6,300 feet, Hall 9311; southeastern approaches to Castle Peak, Heller 7062; Blue Lakes, 8,500 feet, Hansen 1252; near Suzy Lake, Tahoe, 7,600 feet, Smiley 167; Tallac sawmill, Tahoe, 6,400 feet, Smiley 141; Glen Alpine, Dudley, June 28, 1900; Caple's Lakes, Alpine County, 8,500 feet, Hansen 587; peak south of Sonora Pass, 9,000 feet, Brewer 1923; Ebbett's Pass, 9–12,000 feet, Brewer 1993; Tioga Road west of Lake Tenaya, Yosemite, 7,900 feet, Smiley 585; Volcano Creek, Tulare County, 7,500 feet, Hall and Babcock 5426.

Typical *C. Nuttallii* T. and G. is a widely ranging species in western North America while this variety, distinguished by the paler colored flowers and anthers more or less sagittate at base, is strictly of the Sierran region and is found at a higher level than the species.

5. ERYTHRONIUM

1. **Erythronium purpurascens** Wats., Proc. Am. Acad., vol. 12, p. 277. 1877.

Type locality.—"In the Sierra Nevada: near Downieville, Sierra Co., and frequent in Plumas Co."

Range.—Sierra Nevada.

Zone.—Upper Transition and Canadian.

Specimens examined.—Plumas County, Mrs. R. M. Austin in 1876; Downieville, Dr. J. M. Bigelow (type); near snowbank on north side of Shuteye Mountain, Madera County, 8,200 feet, J. Murdoch Jr. 554; Mt. Moses, Tulare County, rocky places, 8–9,000 feet, Purpus 1341.

6. NARTHECIUM

1. **Narthecium californicum** Baker, Jour. Linn. Soc., vol. 15, p. 351. 1876.

N. ossifragum var. *occidentale* A. Gray, *in* Bolander, Pl. Calif., p. 15. 1870.
Abama-Abama californica Heller, Cat. N. Am. Pl., p. 36. 1898.

Type locality.—"Swamps at Red Mountains." (Mendocino County.)

Range.—In the Sierra north from the Yosemite region and in the North Coast Ranges of California, extending into southern Oregon.

Zone.—Transition and Canadian.

Specimens examined.—Sierra County, Lemmon 585; side of Downieville Peak, Lemmon, September, 1877; Tuolumne Cañon, Yosemite, 7,500 feet, F. M. Reed, July 21, 1911 (U. C. no. 161233).

7. TOFIELDIA

1. **Tofieldia occidentalis** Wats., Proc. Am. Acad., vol. 14, p. 283. 1879.

Type locality.—"N. California (Mendocino County, n. 1022 Kell. & Harf.) to Washington Territory (Cascade Mountains, Lyall)."

Range.—Pacific Coast states.

Zone.—Canadian to Hudsonian.

Specimens examined.—Half-moon Lake, Tahoe, 7,760 feet, McGregor 63; Alta meadows, Tulare County, Mrs. Brandegee, August 1, 1895; Gilbert Lake and Kearsarge Pass, Tulare County, S. W. Austin 367; wet meadows on Little Kern River, 9–10,000 feet, Purpus 5232; along streams on Hockett's meadows, Tulare County, 8,500 feet, Hall and Babcock 8458.

While this species can usually be separated without difficulty from *T. glutinosa* (Michx.) Pers. of the east, I am at a loss in trying to find characters by which *T. intermedia* Rydb. (Bull. Torr. Bot. Club, vol. 27, p. 528. 1900) can be distinguished from Dr. Watson's species; certainly those differences pointed out by Dr. Rydberg as distinguishing his species from the eastern *T. glutinosa* are precisely those defining *T. occidentalis*.

8. ZYGADENUS

1. **Zygadenus venenosus** Wats., Proc. Am. Acad., vol. 14, p. 279. 1879.

Type locality.—Not given; Monterey County according to the label on the type collection by Brewer.

Range.—California to British Columbia and western Nevada.

Zone.—Arid Transition and Canadian.

Specimens examined.—Plumas County, Mrs. Austin in 1878; Silver Lake, 2,000 feet, Hansen 584; meadow near Fallen Leaf Lake, Tahoe, Miss Lathrop, July 12, 1909; Half Moon Lake, Tahoe, 8,200 feet, Hall and Chandler 4691; Lily Lake meadow, Tahoe, 6,700 feet, Smiley 393; Yosemite Valley and mountains, Torrey 514; meadows along Little Kern River, Tulare County, 9–9,500 feet, Purpus 1817.

9. SMILACINA

Raceme simple; stamens shorter than the perianth segments their filaments slender ....1. S. sessilifolia
Raceme compound (inflorescence paniculate); stamens exceeding the perianth segments, their filaments broadened ....2. S. amplexicaulis

1. **Smilacina sessilifolia** Nutt., *in* Wats., Proc. Am. Acad., vol. 14, p. 245. 1879.

Vagnera sessilifolia Greene, Man. Bay Region, p. 316. 1894.
Tovaria sessilifolia Baker, Jour. Linn. Soc., vol. 14, p. 566. 1875.
Smilacina stellata sessilifolia Henderson, Bull. Torr. Bot. Club, vol. 27, p. 358. 1900.

Type locality.—"America borealis occidentalis a Columbia brittanica ad Californiam et Mexicum Novum."

Range.—Throughout the Cordilleran section and west to the Pacific Coast.

Zone.—Arid Transition and Canadian.

Specimens examined.—Grass Lake, Tahoe, McGregor 99; Porcupine Flat, Yosemite, 8,000 feet, R. A. Ware 2651c; Long Cañon, Tulare County, 7,000 feet, Hall and Babcock 5300; Natural Bridge, Tulare County, Culbertson (B 4362).

2. **Smilacina amplexicaulis** Nutt., Jour. Acad. Phila., vol. 7, p. 58. 1834.

S. racemosa var. *amplexicaulis* Wats., Bot. King's Exped., p. 345. 1871.
Vagnera amplexicaulis Greene, Man. Bay Region, p. 316. 1894.
Vagnera pallescens Greene, Proc. Acad. Phila., 1895, p. 551. 1896.
Vagnera brachypetala Rydb., Bull. Torr. Bot. Club, vol. 28, p. 268. 1901.

Type locality.—"In the valleys of the Rocky Mountains about the sources of the Columbia River." *Wyeth.*

Range.—Throughout the Cordilleran section and west to the Pacific Coast.

Zone.—Arid Transition and Canadian.

Specimens examined.—Independence Lake, Dudley, June 19, 1900; Grass Lake, Tahoe, 7,200 feet, McGregor 89; near Glen Alpine Springs, Tahoe, Miss Lathrop, July 19, 1909; Carson Spur, Alpine County, 8,500 feet, Hansen 581; Mt. Raymond, Madera County, in summit rocks, 8,700 feet, Smiley 546*; Long Lake, Plumas County, 6,700 feet, Hall 9320*; Shuteye Mountain, Madera County, 7,900 feet, Smiley 562; South Fork of Kaweah River, Tulare County, 8,000 feet, Culbertson (B 4252).

Unifolium lilaceum Greene (Pitt., vol. 1, p. 281. 1889), described as "A species inhabiting the higher Sierra in California, extending northward indefinitely," is unknown to me in authentic specimens: Greene (*l.c.*) compares it to *S. sessilifolium,* which he claims is confined to the Coast Range, while Wooton and Standley (Contr. Nat. Herb., vol. 19, p. 139. 1915) find no constant character by which it may be distinguished from *S. stellata* Desf.

10. VERATRUM

1. **Veratrum californicum** Durand, Jour. Acad. Phila. II, vol. 3, p. 103. 1855.

V. speciosum Rydb., Bull. Torr. Bot. Club, vol. 27, p. 531. 1900.

Type locality.—Not given; the type collected by *Pratten* near Nevada City on Deer Creek.

Range.—Pacific Coast and northern Rockies, perhaps south to Chihuahua.

Zone.—Transition and Canadian.

Specimens examined.—Plumas County, Mrs. R. M. Austin in 1878; Mt. Rose, 10,000 feet, Kennedy 1194; about Marlette Lake, east of Tahoe, 2460 m., Baker 1864; Silver Lake, Amador County, 7,200 feet, E. Mulliken 134; Half-Moon Lake, Tahoe, 8,200 feet, Hall and Chandler 4697; same locality, 7,760 feet, McGregor 50; high ridge above Donner Pass, 8,000 feet, Heller 7177; Lake of the Woods meadow, Tahoe, 8,100 feet, Smiley 67; Grizzly meadow, near Little Shuteye Pass, Madera County, 6,000 feet, Abrams 4926; Summit, Mrs. Brandegee, July 15, 1908; Little Kern River, Tulare County, 8,500 feet, Culbertson (B 4322).

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* These collections represent a form in the higher mountains in which the usual hispid pubescence is nearly or entirely wanting, but plants from intermediate levels show all possible gradations between the extremes.

11. XEROPHYLLUM

1. **Xerophyllum tenax** Nutt., Gen., vol. 1, p. 235. 1818.

Helonias tenax Pursh., Fl., vol. 1, p. 245. 1814.
Xerophyllum Douglasii Rydb., Mem. N. Y. Bot. Gard., vol. 1, p. 92. 1900, not of Wats.

Type locality.—"On the high lands near the Rocky Mountains." *Lewis.*

Range.—Southeastern Alaska to the northern Sierra Nevada and Coast Range, east to Montana.

Zone.—Canadian in our range.

Specimens examined.—High mountains of Plumas County, Mrs. Austin in 1876; Sierra County, Lemmon 1056.

12. FRITILLARIA

1. **Fritillaria gracillima**, sp. nov.

Bulbus parvulus, squamis carnosis. Caulis simplex, gracillimus, foliatus 20–30 cm. altus, decumbens. Folia anguste linearia (4–6 cm. longa, 2.5–3.5 mm. lata), apicibus recurvis. Flos solitarius, terminalis: segmenta perianthii subequalia, ovata sed abrupte acuminata (12–14 mm. longa, 6.5 mm. lata), involuta, in unguem contracta. Stamina vix basi segmentorum perianthii affixa: filamentis filiformis sed basi leviter dilatatis. Styli ad apicem paene ovarii distincti, filiformis, superiore styli quarta parte stigmatosa. Fructus incognitus.

(Bulb small, formed of a few fleshy scales. Stems simple, very slender, 20–30 cm. long, decumbent. Leaves all alternate, 4–6 cm. long, 2.5–3.5 mm. broad, narrowly linear or gramineous with recurving tips, green and, like the rest of the plant, completely glabrous. Flowers solitary, terminal the perianth segments clawed at base and abruptly acuminate at the apex. Stamens hardly attached to the base of the perianth segments with slender filaments, which broaden slightly below. Styles free nearly to the top of the ovary, the stigmatic portion forming about ¼ their length. Fruit unknown.)

Type collected on Mt. Lyell, Yosemite National Park, in the alpine zone and found growing on a north slope at 10,500 feet, *Hall and Babcock* 3562, July 18, 1902.

This alpine Fritillaria has its nearest ally in *F. atropurpurea* Nutt. but differs from that species in the very slender habit, reclining stems, gramineous leaves, none of which are verticillate, the single-flowered stems and deeply divided style. The other species of the genus found in the Sierra, *F. pinetorum* Davidson, is glaucous, thick-stemmed, and has an inflorescence of several darker colored flowers; it is as yet only known from the Yellow Pine belt of the southern Sierras and Tehachapi Mountains.

13. LILIUM

1. **Lilium parvum** Kellogg, Proc. Calif. Acad., vol. 2, p. 179, fig. 12. 1862.

Type locality.—Not given.

Range.—Sierra Nevada.

Zone.—Transition and Canadian.

Specimens examined.—Summit Camp, Kellogg, July 14, 1870; high mountain near Donner Pass, Torrey 526; Glen Alpine, Tahoe, Setchell and Dobie, July 6–21, 1901; Silver Lake, Amador County, 7,200 feet, E. Mulliken 140; Cisco, Placer County, Hall 8755; Grass Lake, Tahoe, McGregor 2; Blue Lakes, Alpine County, 8,500 feet, Hansen 593; Donner Lake, Heller 6995; between Fallen Leaf Lake and Glen Alpine, Tahoe, Miss Lathrop, July 12, 1909; below Lucile Ridge, Eldorado County, Dudley, June, 1900; Lily Lake marsh, 6,700 feet, Smiley 314.

1a. **Lilium parvum** var. **luteum** Purdy, Erythea, vol. 5, p. 105. 1897.

Type locality.—"Plumas County." *Mrs. Austin.*

Range.—Apparently to the south of the specific range for the most part.

Specimens examined.—Butterfly Valley, Plumas County, 3,800 feet, Hall 9273; Coyote Creek, Tulare County, Culbertson (B 4333); Hockett's meadow, Tulare County, Culbertson (B 4296).

This variety is very doubtfully worthy of taxonomic recognition since its only character is the revolute shape to the petals.

Hansen[100] says that he noted two forms of *L. parvum* in the central Sierra: a small pale green plant with few (2–7) flowers, and a large robust form with dark foliage and having an inflorescence of 20–50 flowers. These forms I have not been able to discriminate among the specimens cited above though according to Hansen they are very different in appearance and with consistent character.

Lilium Washingtonianum Kellogg (Proc. Calif. Acad., vol. 2, p. 13. 1863), the most beautiful of the wild lilies of California, grows in the chaparral of the upper Transition and occasionally encroaches upon our lower borders (east slope Cathedral Peak, Tahoe, 6,400 feet, Smiley 212).

14. IRIDACEAE (IRIS FAMILY)

1. SISYRINCHIUM

Ovary glabrous; flowers yellow ....1. **S. Elmeri**
Ovary sparsely glandular-hairy; flowers purple ....2. **S. oreophilum**

1. **Sisyrinchium Elmeri** Greene, Pitt., vol. 2, p. 106. 1890.

Type locality.—"Lake Eleanor, in the Sierra Nevada." Yosemite.

Range.—Sierra Nevada.

Zone.—Transition mainly, rising into the Canadian.

Specimens examined.—Lake Eleanor, Yosemite, Chestnut and Drew, June 28, 1889 (co-type); Yosemite and Wawona Turnpike, Mariposa County, Congdon, June 5, 1897; wet meadows on Little Kern River, 10,000 feet, Purpus 5237 and 2020. Miss Eastwood[3] noted this species along Bubb's Creek, Tulare County.

2. **Sisyrinchium oreophilum** Bicknell, Bull. Torr. Bot. Club, vol. 31, p. 381. 1904.

Type locality.—"Mariposa County: Yosemite Valley."

Range.—Sierra Nevada.

Specimens examined.—Yosemite Valley, 7,600 feet, F. T. Bioletti, May-June, 1900; South Fork San Joaquin River, 8,000 feet, Hall and Chandler 652.

Very doubtfully distinct from the common *S. bellum* Wats.

15. ORCHIDACEAE (ORCHIS FAMILY)

Leaves 2, somewhat orbicular; flowers greenish with a conspicuous flat 2-lobed lower lip ....1. **Listera**
Leaves several to many, several times as long as broad.
  Flowers in a twisted spike; none of the petals spurred ....2. **Spiranthes**
  Flowers in a stright spike or raceme; lower petal with a slender spur at base. ....3. **Habenaria**

1. LISTERA

1. **Listera convallarioides** Torr., Fl. N. U. S., p. 320. 1826.

Epipactis convallarioides Swartz, Kongl. Vet. Akad. Handl. Stockh. II, vol. 21, p. 232. 1800.
Listera Eschscholtziana C. and S., Linnaea, vol. 3, p. 33. 1828.
Ophrys convallarioides W. F. Wight, Bull. Torr. Bot. Club, vol. 32, p. 380. 1905.

Type locality.—"E. Terra Nova Amer. sept."

Range.—Newfoundland to Alaska, south to northern Vermont, Great Lakes, Colorado, and California.

Zone.—Transition and Canadian.

Specimens examined.—Upper end Donner Lake, Heller 6996; Glen Alpine, Tahoe, 7,000 feet, McGregor 37; near Lily Lake, Tahoe, marshy woods, 6,800 feet, Smiley 317; South Fork of the San Joaquin, J. Muir in 1873.

2. SPIRANTHES

1. **Spiranthes Romanzoffiana** Cham., Linnaea, vol. 3, p. 32. 1828.

Gyrostachys romanzoffiana MacM., Met. Minn., p. 171. 1892.
Gyrostachys stricta Rydb., Mem. N. Y. Bot. Gard., vol. 1, p. 107. 1900.
Ibidium romanzoffiana (Cham.) House, Muhl., vol. 1, p. 129. 1906.

Type locality.—"In alveo turfuso convallium infimorum Unalascheae passim."

Range.—Subarctic America from Newfoundland to Alaska, south to Connecticut, Great Lakes, Colorado, and California. In New Mexico (Wooton and Standley, Contr. Nat. Herb., vol. 19, p. 154. 1915).

Zone.—Transition and Canadian.

Specimens examined.—Lake Valley, Tahoe, 6,400 feet, Abrams 4777; vicinity of Angora Lake, Tahoe, 7,000 feet, McGregor 211; high mountain near Donner Pass, Torrey 509; Cascade Mountains, Tahoe, Chestnut and Drew, August 8, 1890; Hopkins Creek above Yosemite, Lemmon in 1873; Tioga Road above Aspen Valley, Yosemite, 6,800 feet, Smiley 898; Billy Brown meadows, 6,500 feet, Shuteye Mountain, Madera County, J. Murdoch Jr., 1551; region of Dinkey Creek, Hall and Chandler 569; Hockett meadows, Tulare County, 8,500 feet, Hall and Babcock 5626; Whitney meadows, Tulare County, in granite sand and gravel all about the meadows and above timber line, Coville and Funston 1633; northwest of Whitney meadows along North Fork of Kern River, Tulare County, V. Bailey 1713.

3. HABENARIA

Flowers shorter than the bracts; plants of moist places.
    Flowers greenish; spike loosely flowered ....1. **H. sparsiflora**
    Flowers white; spike densely flowered ....2. **H. dilatata** var. **leucostachys**
Flowers much longer than the bracts; plants of dry places ....3. **H. unalaschensis**

1. **Habenaria sparsiflora** Wats., Proc. Am. Acad., vol. 12, p. 276. 1877.

Limnorchis sparsiflora (S. Wats.) Rydb., Bull. Torr. Bot. Club, vol. 28, p. 631. 1901.

Type locality.—"Common in the Sierra Nevada and mountains of northern California."

Range.—California north to Oregon and east to Colorado and New Mexico.

Zone.—Transition and Canadian.

Specimens examined.—Near Donner Lake, Torrey 511; Half-Moon Lake, Tahoe, 8,200 feet, Hall and Chandler 4700; Mt. Dyer, Plumas County, Mrs. R. M. Austin, July, 1879; Lake Tenaya, Yosemite, 8,100 feet, Smiley 691; same locality, 8,300 feet, Hall and Babcock 3510; above soda springs of the San Joaquin, Congdon, August 14, 1899; Mt. Olancha, Tulare County, on Monache Creek, 8,500 feet, Hall and Babcock 5269; Shuteye Mountain, Madera County, 8,100 feet, Smiley 567.

2. **Habenaria dilatata** var. **leucostachys** (Lindl.) O. Ames, Orchid., vol. 4, p. 71. 1910.

Platanthera leucostachys Lindl., Gen. and Sp. Orchid. Pl., p. 288. 1835.
Habenaria leucostachys Wats., Bot. Calif., vol. 2, p. 134. 1880.
Limnorchis leucostachys (Lindl.) Rydb., Mem. N. Y. Bot. Gard., vol. 1, p. 106. 1900.

Type locality.—"Hab. in ora occidentali Americae septentrionalis."

Range.—British Columbia to southern California, east to Utah.

Zone.—Transition and Canadian.

Specimens examined.—Plumas County, Mrs. Austin in 1877; Cisco, Kellogg, June 21, 1870; Silver Lake, Amador County, 7,200 feet, E. Mulliken 141; lower end Donner Lake, Heller 6919; Half-Moon Lake, Tahoe, 8,200 feet, Hall and Chandler 4699; meadows near Meisner's sheep-ranch, Eldorado County, 7,600 feet, Brainerd, July 17, 1897; Hopkins Creek above Yosemite, Lemmon in 1873; trail to Clouds' Rest, Yosemite, 7,600 feet, Smiley 495; Mineral King, Tulare County, 8–9,000 feet, Dr. E. Palmer 223; same locality, Eastwood, July 13, 1903; near Glen Alpine, Tahoe, 7,500 feet, Smiley 193.

3. **Habenaria unalaschensis** (Spreng.) Wats., Proc. Am. Acad., vol. 12, p. 277. 1877.

Spiranthes unalaschensis Spreng., Syst., vol. 3, p. 708. 1826.*

Type locality.—"Ins. Aleut."

Range.—Alaska to the Gulf of St. Lawrence; south in the west to southern California and Wyoming.

Zone.—Transition and Canadian.

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* For complete synonymy see Ames, The Genus Habenaria in North America, Orchidaceae, fasc. 4. 1910, Boston.

Specimens examined.—Woods near Fallen Leaf Lake, Tahoe, Miss Lathrop, July 22, 1909; near Glen Alpine on trail to Suzy Lake, 7,800 feet, Smiley 194; above Fallen Leaf Lake, near Camp Agassiz under *Juniperus occidentalis,* Tahoe, 6,800 feet, Smiley 358; near Tamarack Flat, Yosemite, 6,500 feet, Abrams 4887; Snow Creek, Yosemite, dry fir forests, 6,800 feet, Hall 9184; above Sonora Pass, Brewer 1933; slope above Home Camp meadow, Fresno County, 6,900 feet, Smiley 651; General Grant National Park, Brandegee, July 20, 1892; North Fork of King's River, Tulare County, 7,000 feet, Hall and Chandler 554.

The Ghost Orchid—*Cephalanthera Austinae* (Gray) Heller—and *Corallorhiza multiflora* Nutt. are sometimes taken above our lower limits.

16. SALICACEAE (Willow Family)

Scales entire or merely toothed, persistent; stamens (in ours) not more than 2; stigmas short; buds with several scales .... 1. **Salix**
Scales lacerate, caducous; stamens more than 6, usually numerous; stigmas elongated; buds with a single scale .... 2. **Populus**

1. SALIX

Low depressed alpine dwarfs with creeping branches rooting at the nodes and with short (1.5–3 inch) erect leafy branches bearing the catkins.
  Leaves acute or acuminate, equally green on both sides with margins plane, not at all rugose above; scales of the aments dark brown to black, densely hirsute .... 1. **S. tenera**
  Leaves oblong-obovate to suborbicular, obtuse or retuse, with margins often revolute, dark green and somewhat rugose above, very glaucous below; scales of the aments light yellow, nearly glabrous .... 2. **S. nivalis**
Taller shrubs with ascending or erect branches (at least not creeping).
  Twigs and smaller branches covered with a pruinose bloom; leaves oblanceolate, silky-sericeous, becoming glabrate and green above; style obsolete and stigma appearing sessile .... 3. **S. macrocarpa**
  Twigs and branches yellowish-green or brown, not pruinose.
    Ovary and capsule always glabrous .... 4. **S. cordata** var. **Watsoni**
    Ovary and capsule pubescent, at least at first.
      Pistillate catkins short, densely flowered, subglobose when mature, on very short nearly leafless branches and appearing sessile; leaves ½–1 inch long, glabrous and bright green above .... 5. **S. monica**
      Pistillate catkins elongate-cylindrical, obviously pedunculate.
        Stamens 2, the filaments distinct.
          Leaves early glabrate and green on both sides; pistillate catkins short peduncled, their scales very dark; styles short or sometimes nearly obsolete .... 6. **S. Lemmoni**
          Leaves, if glabrate above, permanently pubescent below; the scales of the catkins brown or reddish; styles elongated.
            Leaves entire or nearly so, without marginal glands .... 7. **S. glaucops**
            Leaves glandular-serrate .... 8. **S. californica**
        Stamens 1 (or if 2, the filaments more or less united); leaves somewhat revolute and silvery-silky below .... 9. **S. sitchensis** var. **angustifolia**

1. **Salix tenera** Anderss., *in* DC. Prodr., vol. 16, pt. 2, p. 288. 1868.

S. artica Pallas var. *petraea* Anderss., *l.c.*, p. 287.
S. Brownii Bebb var. *petraea* Bebb, Bot. Gaz., vol. 14, p. 115. 1889.
S. petrophila Rydb., Bull. N. Y. Bot. Gard., vol. 1, p. 268. 1899.
S. caespitosa Kennedy, Muhl., vol. 7, p. 135. 1912.

Type locality.—"In America septentrionali, ad Cascade-mountain, lat. 49, alt. 7000 ped."

Range.—British Columbia and mountains of Alberta south to the southern Sierra Nevada through the Cascades and through the Rockies to New Mexico.

Zone.—Arctic-alpine.

Specimens examined.—Mt. Rose, 10,000 feet, Kennedy 1173 (cotype of *S. caespitosa* in U. C.); Dick's Peak, Tahoe, 10,000 feet, Smiley 431; Sierra County, Lemmon 208 (without definite locality); Mt. Dana, 10–11,000 feet, Brewer 1734; same locality, Congdon, August 11, 1898; Mt. Gibbs, Yosemite, 12,200 feet, Smiley 760; Mt. Lyell, 10,800–11,000 feet, Hall and Babcock 3584; Mt. Goddard, 11,100 feet, Hall and Chandler 685; Milestone Plateau near Mt. Whitney, Tulare County, Dudley 2463; Mt. Brewer above Bubb's Creek, 12,000 feet, E. B. Copeland, August 7, 1899.

As is indicated by the above synonymy, I am unable to find any characters by which it is possible to distinguish the recently published segregates from the *S. tenera* of the northern Cascades and Rockies. This and the next are the only true alpine willows of the Sierra, none of the genuine arctic species reaching our region.

2. **Salix nivalis** Hook., Fl. Bor. Am., vol. 2, p. 152. 1839.

S. reticulata var. *nivalis* Anderss., *in* DC. Prodr., vol. 16, pt. 2, p. 301. 1868.
S. saximontana Rydb., Bull. N. Y. Bot. Gard., vol. 1, p. 261. 1899.

Type locality.—"Near the summits of the peaks in the Rocky Mountains."

Range.—British Columbia and Alberta south in the Rockies to northern New Mexico and in the Cascade-Sierra to the central Sierra Nevada (?).

Zone.—Arctic-alpine.

Specimen examined.—Mt. Dana, Theo. Labouchere, July, 1915.

S. saximontana, described from an alpine willow collected on Grays Peak, Colorado, is an exact synonym for the older *S. nivalis.* Dr. Rydberg, in a note subjoined to the description, says, "In Montana it seems to grade into *S. nivalis,*" and, referring to the last named species, states that it "is nearest related to *S. saximontana*, and perhaps represents only the most depauperate form thereof." Professor Piper[72] includes *S. saximontana* among the willows of Washington, with the comment: "Probably not specifically distinct from *S. nivalis*." The above cited specimen is the only known collection from California.

3. **Salix macrocarpa** Nutt., var. **argentea** Bebb, Bot. Gaz., vol. 10, p. 225. 1885.

S. Geyeriana Anderss., Sal. Bor. Am., p. 63(17). 1858.
S. Covillei Eastwood, Zoe, vol. 5, p. 80. 1900.

Type locality.—Plumas and Sierra counties.

Range.—Sierra Nevada, northward to Idaho.

Zone.—Upper transition and Canadian.

Specimens examined.—Near Red Clover Valley, Plumas County, Heller and Kennedy 8728; Donner Lake meadow, Tahoe region, Dudley 5001; Lake Valley, Tahoe, Abrams 4778; Twin Lakes, Alpine County, 8,500 feet, Hansen 199; South Fork of the San Joaquin, 6,700 feet, Hall and Chandler 632; Golden Trout Creek, Tulare County, 8,500 feet, H. M. and G. R. Hall 8415; Whitney meadows, 8–9,000 feet, Purpus 1893.

This variety of the more northern species is a common willow in the Sierra about sandy meadows or in washes in the streams; it becomes 12–16 feet high, forming a very attractive coppice because of its glistening foliage.

4. **Salix cordata** var. **Watsoni** Bebb, *in* Wats., Bot. Calif., vol. 2, p. 86. 1880.

Type locality.—"Near Carson City (*Watson*), and in Sierra County, *Lemmon*."

Range.—Mountains of California from the San Jacintos northward through the Sierra and eastward in the Great Basin.

Zone.—Arid Transition and entering the Canadian.

Specimens examined.—Johnson Lake above Crescent Lake, Yosemite, Congdon, August 2, 1898; Yosemite Valley, Abrams 4492.

5. **Salix monica** Bebb, *in* Wats., Bot. Calif., vol. 2, p. 90. 1880.

Type locality.—"Mono Pass summit."

Range.—High peaks of the central Sierra Nevada.

Zone.—Arctic-alpine and extending downward below timber line.

Specimens examined.—Mono Pass summit, Brewer 1732; near head of Mono Pass, Congdon, August 13, 1898; Bloody Cañon, Mono County, Congdon, August 16, 1894; soda springs of the Tuolumne, Yosemite, Congdon, August 1, 1898.

6. **Salix Lemmoni** Bebb, *in* Wats., Bot. Calif., vol. 2, p. 88. 1880.

Type locality.—"Sierra County."

Range.—Eastern Oregon through the Warner Mountains to the Yosemite region of the Sierra and eastward in the mountains of the Great Basin.

Zone.—Transition (Upper) and Canadian.

Specimens examined.—Shore of Webber Lake, Sierra County, the common willow here, Dudley, August 29, 1894; Sierra County, Lemmon; Iceberg meadow, Alpine County, 6,500 feet, Abrams 4745; divide south of Slide Mountain, Washoe County, Nevada, 7,600 feet, Heller 10926, 10928; shores of Red Lake, Black Mountain, Fresno County, 9,500 feet, Hall and Chandler 733; Lake of the Woods, Tahoe, Dudley, September 1, 1894.

7. **Salix glaucops** Anderss., *in* DC. Prodr., vol. 16, pt. 2, p. 281. 1868.

S. glauca var. *villosa* Anderss., Sal. Bor. Am., p. 22. 1858.
S. villosa Don, *in* Hook., Fl. Bor. Am., vol. 2, p. 144. 1830, not of Schleich, 1815.
S. Seemannii Rydb., Bull. N. Y. Bot. Gard., vol. 2, p. 164. 1901.
S. wyomingensis Rydb., Bull. Torr. Bot. Club, vol. 28, p. 271. 1901.

Type locality.—"In omni America septentrionali usque ad fl. Saskatchewan crescore dicitur."

Range.—Throughout the Cordilleran section and west to the Pacific Coast south of Washington.

Zone.—Canadian to Arctic-alpine.

Specimens examined.—Summit, Heller 6970; Suzy Lake, Tahoe, McGregor 106; between Donner Lake and Summit, Dudley 5076; Carson Spur, Alpine County, 8,500 feet, Hansen 800; Highland Lake, Alpine County, 8,500 feet, Abrams 4751; Blue Lakes, Alpine County, 8,000 feet, Abrams 4755; near Lake Lucile, Tahoe, 9,000 feet, forming a mat 8 feet in diameter, Smiley 50; Pyramid Peak, 9,500 feet, Smiley 117; Desolation Valley, Tahoe, 8,700 feet, Smiley 77, 78; shores of Heather Lake, Tahoe, 8,000 feet, Smiley 283; Crescent Lake, Mariposa County, Congdon, August 9, 1890; Mt. Dana, 11,500 feet,

R. A. Ware 2621c; Bloody Cañon, Mono County, Congdon, August 13, 1898; Cathedral trail, Yosemite, Congdon, August 7, 1898; Tuolumne meadows, shores of Elizabeth Lake, 9,800 feet, Smiley 790; above timber line, White Chief mine, Mineral King, Hall and Babcock 5653; along brooks at Farewell Gap, Tulare County, 11–12,000 feet, Purpus 5163.

8. **Salix californica** Bebb, *in* Wats., Bot. Calif., vol. 2, p. 88. 1880.

Type locality.—"This occurs in the Sierra Nevada at lower altitudes (8,000 to 9,000 feet) than the preceding (*S. glaucops*), from Mariposa County northward."

Range.—Sierra Nevada.

Zone.—Canadian mainly, generally replacing *S. glaucops* in that zone.

Specimens examined.—Sierra County, Lemmon in 1874; between Donner Lake and Summit, Dudley 5071; near Donner Pass, Brewer 2162; Mt. Rose, 9,650 feet, Heller 9909; about Marlette Lake, Washoe County, Nevada, 2460 m., Baker 1299; along the crest of Mt. Lola, Tahoe, 8,000 feet, Hall and Babcock 4534; Suzy Lake Basin, Tahoe, 7,900 feet, Smiley 187; soda springs of the Tuolumne, Yosemite, Congdon, August 15 (year not given); Snow Flat, Yosemite, Hall and Babcock 3496; Dog Lake, Tuolumne meadows, 9,240 feet, Smiley 843; Tuolumne meadows, R. A. Ware, July 17, 1907; Mt. Goddard, 10,000 feet, Hall and Chandler 659; Kaiser Crest, Fresno County, 9,100 feet, Smiley 625.

9. **Salix sitchensis** var. **angustifolia** Bebb, *in* Wats., Bot. Calif., vol. 2, p. 87. 1880.

Type locality.—"On a high mountain near Donner Pass."

Range.—Sierra Nevada northward probably to British Columbia.

Zone.—Upper Transition and Canadian.

Specimens examined.—Gilmore Lake, Mt. Tallac, 8,300 feet, Abrams 4854; creek between Heather and Suzy Lakes, 7,800 feet, Smiley 144; near Summit, Dudley 5072, 5072a.

2. POPULUS

Leaves orbicular with abrupt tip; petioles compressed; stamens few (6–12); small shrub or tree ....1. **P. tremuloides**
Leaves ovate or lanceolate, somewhat cordate at base; petioles not compressed; stamens numerous (40–60); large tree ....2. **P. trichocarpa**

1. **Populus tremuloides** Michx., Fl. Bor. Am., vol. 2, p. 243. 1803.

Type locality.—"Hab. in Canada et Noveboraco."

Range.—Subarctic America south to California. New Mexico, Missouri, and the Middle States.

Zone.—Transition and Canadian.

Specimens examined.—Webber Lake, Sierra County, Dudley, June, 1900; Glen Alpine, Tahoe, 6,800 feet, McGregor 202; Carson Spur, Alpine County, 8,500 feet, Hansen 197; Angora Peak, forming chaparral along the east side, 7,800 feet, Smiley 18; Tenaya Lake, Yosemite, 8,100 feet, Smiley 692; Lake of Islands, near Kaweah Peaks, Tulare County, 11,000 feet, Dudley, August 31, 1894.

The aspen is a very common member of the high mountain chaparral and in the Sierra does not seem to form the groves of tall slender trees that are so conspicuous in many parts of the Colorado mountains.

2. **Populus trichocarpa** T. and G., *in* Hook., Ic. Pl., vol. 9, p. 878. 1852.

Type locality.—"Santa Clara River, near Beneventano (Ventura), California."

Range.—British Columbia to northwest Montana, south to southern California.

Zone.—From the Upper Sonoran into the Canadian.

Specimens examined.—Donner Lake, Dudley, June 14, 1900; between Fallen Leaf and Glen Alpine, Tahoe, 6,800 feet, Smiley 207; Carson Spur, Alpine County, 8,500 feet, Hansen 803; South Fork of the San Joaquin, 6,700 feet, Hall and Chandler 727.

At the higher levels the characters of this tree vary somewhat from the typical, the foliage becomes whiter, the leaf-form changes to a longer and narrower type of leaf, while the cordate base is completely lost, the leaf-base being truncate or even ovate.

17. BETULACEAE (BIRCH FAMILY)

Pistillate catkins clustered, becoming pendulous oval woody cones, their persistant scales 5-lobed at the apex; stamens 1–7 ....1. **Alnus**

Pistillate catkins solitary, the ultimately deciduous scales 3-lobed at the apex; stamens 2 ....2. **Betula**

1. ALNUS

1. **Alnus tenuifolia** Nutt., Sylva, vol. 1, p. 32. 1842.

A. incana var. *virescens* Wats., Bot. Calif., vol. 2, p. 81. 1880.
A. occidentalis Dippel, Handb. Laubh., vol. 2, p. 158. 1892.

Type locality.—"On the borders of small streams within the Range of the Rocky Mountains, and afterwards in the valleys of the Blue Mountains of Oregon."

Range.—British Columbia and Mackenzie south to California and New Mexico.

Zone.—Transition and Canadian.

Specimens examined.—Near Donner Lake, Heller 6952; Lake Tahoe, Dudley, August 23, 1909; Glen Alpine, W. W. Price, July, 1898; Grass Lake, Tahoe, 7,200 feet, McGregor; Carson Spur, Alpine County, 8,500 feet, Hansen 809; shores of Suzy Lake, Tahoe, 7,800 feet, Smiley 174; Angora Lake, Tahoe, 8,000 feet, Smiley 35; Chiquito Creek, Sierra National Forest, 6,000 feet, Abrams 4931; Upper San Joaquin, Congdon, August 19, 1895.

Miss Eastwood[89] found this in the Sierra of Tulare County along Bubbs Creek and Kings River.

2. BETULA

1. **Betula glandulosa** Michx., Fl. Bor. Am., vol. 2, p. 180. 1803.

Type locality.—"Circa lacus, a sinu Hudsonia ad Mistassins."

Range.—Subarctic America south to the northern Sierra Nevada, in the Rockies to New Mexico, and in the eastern United States to Minnesota, Great Lakes, and New England.

Zone.—Canadian.

Specimens examined.—Big Meadows, Plumas County, Lemmon, May, 1879; Plumas County, Mrs. Austin in 1878.

No other collections of the Scrub Birch are known from the Sierra though it has been often collected in the Mt. Lassen region and further north in the Warner Mountains of Modoc County; it is barely possible that these specimens were in fact collected farther north than the data on the labels indicate.

18. FAGACEAE (BEECH FAMILY)

Both staminate and pistillate flowers in erect, often branching catkins; fruit a spiny bur ....1. **Castanopsis**
Staminate flowers in pendulous catkins; pistillate flowers sessile in an involucrate-like cup of ultimately woody scales; fruit an acorn ....2. **Quercus**

1. CASTANOPSIS

1. **Castanopsis sempervirens** Dudley, *in* Merriam, Biol. Surv. Mt. Shasta, p. 142. 1899.

Castanea sempervirens Kellogg, Proc. Calif. Acad., vol. 1, p. 71. 1855.

Type locality.—"From the vicinity of Mariposa."

Range.—Coast Ranges and Sierra Nevada to the mountains of southern California. Southern Oregon.

Zone.—Transition and Canadian, occasionally near to timber line.

Specimens examined.—Near timber line on south side of Mt. Tallac, Tahoe, C. H. Merriam in 1898; Glen Alpine, 6,800 feet, McGregor 174; Angora Peak, Tahoe, 8,300 feet, Smiley 22; Castle Peak, east slope in slide rock, 8,300 feet, Smiley 472; Silver Lake, Amador County, 8,000 feet, Hansen 790; trail to Cloud's Rest, Yosemite, 7,900 feet, Smiley 499; Coyote Creek, Tulare County, Culbertson (B 4284); big crag of Alta Peak, Dudley 1357; Kaiser Peak, Fresno County, 9,000 feet, Smiley 623; lower side Mt. Kaweah, 12,500 feet, Dudley 2113; rocky slopes of Little Kern River, 8–9,000 feet, Purpus 5114.

2. QUERCUS

1. **Quercus vaccinifolia** Kellogg, Proc. Calif. Acad, vol. 1, p. 96. 1855.

Q. chrysolepis var. *vaccinifolia* Engelm., Trans. St. Louis Acad., vol. 3, p. 393. 1877. Bot. Calif., vol. 2, p. 97. 1880.

Type locality.—"Trinity, Scott and Siskiyou Mountains."

Range.—Mountains of Northwest California, Mt. Shasta and the Sierra Nevada south to the Kings River region.

Zone.—Canadian mainly.

Specimens examined.—Glen Alpine, Tahoe, W. W. Price, July, 1898; Mt. Tallac, trail at 8,500 feet, Abrams 4826; between Tahoe and Lake Lucile, 7–8,000 feet, Miss K. A. Chandler, September, 1901; Grass Lake, McGregor 10; about Summit Station, Donner Pass, Heller 6980; Silver Lake, Amador County, 8,000 feet, Hansen 204; Plumas County, Mrs. Austin in 1878; near Summit Valley, 8,000 feet, Pringle, September 23, 1882; Angora Lake, Tahoe, 7,700 feet, Smiley 2; Pyramid Peak, base of east slope, 8,500 feet, Smiley 107; Rubicon Peak, chaparral along trail, 8,100 feet, Smiley 411; Ebbett's Pass, a common chaparral oak, Brewer 2037; cliffs of granite on Glacier Point trail, Yosemite, Hooker and Gray in 1877; Panorama Cliffs, Yosemite, 6,500 feet, Hall 9679; Cloud's Rest, 8,600 feet, Smiley 512; Sentinel Dome, Yosemite, Dudley, June 11, 1894; Funston's Trail, Tulare County, Dudley 2090; Lake Tenaya, Yosemite, 7,900 feet, Smiley 694.

19. LORANTHACEAE (Mistletoe Family)

Fruit a globose sessile berry .... 1. **Phoradendron**
Fruit a compressed berry on recurved pedicels .... 2. **Arceuthobium**

1. PHORADENDRON

1. **Phoradendron juniperinum** Engelm., Mem. Am. Acad. II, vol. 4, p. 58. 1849.

Type locality.—"Parasitic on the kinds of shrub cedar (Juniperus) which grow on the hills and elevated plains about Santa Fe, and on no other tree."

Range.—California and Oregon east to Colorado and Texas, south into Mexico.

Zone.—Canadian in the Sierra since its host there is *Juniperus occidentalis.*

Specimen examined.—Vicinity of Mt. Whitney, on Juniper and abundant, Dudley 2467.

Our Sierran form of this leafless Phoradendron is considered by Professor Trelease to constitute a distinct species from the mistletoe found on the Western Juniper from Colorado to northern Mexico. To this Pacific Coast plant the name *Phoradendron ligatum* Trelease (*l.c.*, p. 24), is assigned with the comment: "The western representative of the Rocky Mountain *P. juniperinum,* from which it is scarcely separable except by its curiously constricted scales.

2. ARCEUTHOBIUM

Growing only on *Pinus Murrayana:* male flowers in pseudo-panicles formed by branches simulating peduncles .... 1. **A. americanum**
Growing on other conifers; male flowers in axils of scales in spikes.
  Staminate flowers in short spikes of usually 5 flowers; stems short (1–5 inches high), greenish-yellow in color .... 2. **A. Douglasii** var. **abietinum**
  Staminate flowers in longer spikes (9–17 flowered); stems 4–16 inches high, greenish-brown in color .... 3. **A. campylopodum**

1. **Arceuthobium americanum** Nutt.; Engelm., *in* Gray, Jour. Bost. Soc. Nat. Hist., vol. 6, p. 214. 1850.

Razoumofskya americana (Nutt.) Kuntze, Rev. Gen. Pl., vol. 2, p. 587. 1891.

Type locality.—Oregon.

Range.—British Columbia to Saskatchewan, south to California and Colorado.

Zone.—Canadian, growing only on *Pinus Murrayana.*

Specimens examined.—Near Donner Lake, Tahoe, Dudley, June 7, 1893; Mayers meadow near Truckee, C. F. Sonne; Little Yosemite Valley, Bolander 5095; North Fork of Kings River, Tulare County, 7,000 feet, Hall and Chandler 426.

2. **Arceuthobium Douglasii** var. **abietinum** Engelm., Bot. Calif., vol. 2, p. 106. 1880.

Type locality.—"In Sierra Valley (*J. G. Lemmon*) and S. Utah, *Parry.*"

Range.—California to Washington and Utah.

No specimen of this mistletoe has been seen; it is here included because Hall[101] reports it to grow upon *Abies magnifica* in the Yosemite region.

3. **Arceuthobium campylopodum** Engelm., *in* Gray, Jour. Bost. Soc. Nat. Hist., vol. 6, p. 214. 1850.

A. occidentale Engelm., *in* Wats., Bot. Calif., vol. 2, p. 107. 1880.
Razoumofskya campylopoda (Engelm.) Piper, Contr. Nat. Herb., vol. 11, p. 222. 1906.

Type locality.—"Oregon, on *Pinus ponderosa.*" Collected by Geyer and the region being in fact northern Idaho.

Range.—British Columbia south to California in both the Sierra and Coast Range.

Zone.—Transition and entering the Canadian. Growing mainly on *Pinus.*

Specimens examined.—Mt. Tallac on *P. Jeffreyi,* Dudley, June 8, 1893; Silver Mountain, north side at 7,000 feet, on *Juniperus occidentalis,* Brewer 2055; near Cloud's Rest, Yosemite, Chesnut and Drew, July 13, 1889; Snow Creek, Yosemite, on *P. Jeffreyi,* 6,600 feet, H. M. Hall, July 26, 1911; Mt. Pinos, 8,000 feet, Rothrock 213.

In Washington, this mistletoe has been found parasitic on *Tsuga Mertensiana* (*Allen* 303, Upper Nisqually Valley) but, so far as I know, the Alpine Hemlock has not been found to be attacked in the Sierra.

20. POLYGONACEAE (Buckwheat Family)

- Flowers in involucres; stipules wanting; stamens 9 ....1. **Eriogonum**
- Flowers not in involucres; stipules present, sheathing the nodes; stamens 4–8.
  - The outer sepals smaller and reflexed, the inner accrescent about the fruit.
    - Sepals 4; stigmas 2; achene compressed, thin, broadly 2-winged; leaves reniform ....2. **Oxyria**
    - Sepals 6; stigmas 3; achene triangular in cross-section, not winged; leaves not reniform, usually lanceolate or oblong ....3. **Rumex**
  - Sepals uniform in size and usually not changed in fruit, 5 in number (rarely 4 or 6) ....4. **Polygonum**

1. ERIOGONUM

- Involucres solitary; calyx not stipe-like at base.
  - Involucres borne on the capillary branchlets of the dichotomous panicle; annual with the linear vegetative leaves radical, the few cauline reduced to bracts ....1. **E. spergulinum**
  - Involucres borne on the stout or wiry branches of the inflorescence; perennials with short leafy stems.
    - Leaves oblanceolate to linear (½–1.5 inches long), never fasicled, acute, more or less revolute, white tomentose beneath and glabrate above; involucres cymosely umbellate ....2. **E. microthecum**
    - Leaves oblanceolate, obtusish (¼–1 inch long), some of the smaller fascicled in the axils of the larger, flat, white-woolly on both sides; involucres spicate along the erect branches of the panicle ....3. **E. Wrightii**
- Involucres in heads or umbels (in reduced high mountain forms sometimes solitary, but the calyx then stipe-like at base).
  - Involucres 5–6 nerved, in dense capitate clusters, never umbellate; calyces not stipe-like at base.
    - Leaves densely white tomentose below; glabrate above and green; involucres glabrous or nearly so; stems taller (5 inches–1.5 feet high), glabrous above ....4. **E. nudum**
    - Leaves permanently white-woolly on both sides; involucres woolly; stems low (4–5 inches or less) with 1 or rarely 2 heads.
      - Perianth segments dissimilar, the outer broadly oval and cordate at base, the inner narrow and spatulate ....5. **E. ovalifolium**
      - Perianth segments nearly alike, obovate, cuneate ....6. **E. Kingii**
  - Involucres nerveless; calyces stipe-like at base.
    - Umbels conspicuously bracteate, the bracts large and foliaceous .
      - Involucres deeply lobed, the lobes becoming reflexed.
        - Umbels simple, the rays undivided.
          - Plants pubescent (stems and leaves).
            - Leaves very obtuse or roundish, densely silvery-woolly on both sides; peduncles decumbent; flowers white or pinkish ....7. **E. Lobbii**
            - Leaves ovate, glabrate above; peduncles erect; flowers yellow ....8. **E. umbellatum**
          - Plants glabrous (stems and leaves) ....9. **E. Torreyanum**
        - Umbels compound, bracteate at all the nodes ....10. **E. stellatum**
      - Involucres with short erect teeth; umbel usually compound (3–10 rays); leaves oval or roundish ....11. **E. ursinum**
    - Umbels with a few linear inconspicuous bracts at the base of the rays; involucre with short erect teeth.
      - Rays short, slender, sometimes so reduced as to make the umbel appear capitate; leaves permanently white-tomentose; plants forming thick dense mats ....12. **E. incanum**
      - Rays longer and more numerous; leaves often glabrate above; plants looser, the branches of the caudex spreading ....13. **E. marifolium**

1. **Eriogonum spergulinum** Gray, Proc. Am. Acad., vol. 7, p. 389. 1868.

Oxytheca spergulina Greene, Fl. Fran., p. 153. 1891.
Oxytheca Reddingiana Jones, Bull. Torr. Bot. Club, vol. 9, p. 32. 1882.

Type locality.—"Dry sandy soil, banks of Big Creek below the Mariposa Big-tree Grove." *Bolander.*

Range.—North Coast ranges and Sierra Nevada, northward to southern Idaho.

Zone.—Transition and Canadian.

Specimens examined.—Mt. Tallac, 9,500 feet, McGregor 189; Halfmoon Lake, 7,760 feet, McGregor 48; Caple's Lakes, Alpine County, 8,500 feet, Hansen 304; lower end Donner Lake, Heller 6905; Mono trail, 10,000 feet, Bolander 5098; around shores of Lake Van Orden, near Summit, Kennedy and Doten 235; Soda Springs, Nevada County, Jones 2408 (co-type of *O. Reddingiana*); Hockett's meadows, Tulare County, Culbertson (B 4443); Sky Valley, Tulare County, 10,000 feet, Culbertson (B 4570); very abundant in sandy places on Hockett's meadows, Tulare County, Dudley 1884; Olancha Mountain, 9,400 feet, Rothrock 331; sandy places on Soda Creek, Tulare County, 9–10,000 feet, Purpus 5247; Whitney meadows, dry soil on margins of meadows, 2850 m., Coville and Funston 1622.

2 **Eriogonum microthecum** Nutt., Jour. Acad. Phila. II, vol. 1, p. 162. 1848.

Type locality.—"On the sides of hills in Oregon, east of Walla Walla."

Range.—East slope Sierra Nevada, north to Washington and east to the northern Rockies.

While no specimen of this typically Upper Sonoran species has been identified from our region, it occurs in a dwarf form at Mono Pass and at Sonora Pass—forma *alpina* T. and G. (Proc. Am. Acad., vol. 8, p. 171. 1870): Sonora Pass, 9,000, Brewer 1888; Mono Pass, Bolander 6356.

3. **Eriogonum Wrightii** Torr. var. **subscaposum** Wats., Bot. Calif., vol. 2, p. 29. 1880.

E. curvatum Small, Bull. Torr. Bot. Club, vol. 25, p. 50. 1898.
E. junceum Greene, Leaflets, vol. 1, p. 77. 1904.

Type locality.—"Sierra Nevada and W. Nevada."

Range.—Sierra Nevada southward to the mountains of southern California.

Zone.—Canadian and above.

Specimens examined.—Carson Spur, Alpine County, 8,500 feet, Hansen 760; above Donner Lake toward Donner Pass, Heller 7165; highest part of the Sierra Nevada above Donner Lake, Greene 407; Silver Mountain, Brewer 2059; same locality, Hooker and Gray in 1877; Kaiser Crest, Fresno County, 8,900 feet, Smiley 618; rocky slopes near Soda Creek, Tulare County, 8–9,000 feet, Purpus 5213; top of ridge above Rowell meadow, Fresno County, Dudley, August, 1904.

4. **Eriogonum nudum** Dougl. var. **deductum** Jepson, Fl. Calif., vol. 1, p. 420. 1914.

E. deductum Greene, Pitt., vol. 3, p. 71. 1902.

Type locality.—"Inhabiting the Sierra Nevada of California."

Range.—Higher mountains of California.

Zone.—Canadian.

Specimens examined.—Fallen Leaf Lodge, 6,900 feet, Abrams 4868; Suzy Lake trail, Tahoe, 7,600 feet, McGregor 124; Silver Lake, Amador County, 7,200 feet, E. Mulliken 147; near Summit, Kennedy and Doten 255; Angora Peak, 7,100 feet, Smiley 300; Cascade Lake, Tallac, C. J. Fox Jr., July, 1895; sunny slopes Little Kern River, 9,300 feet, Purpus 5262; Tuolumne meadows, Yosemite, 8,600 feet, R. A. Ware 2656c; Hockett's meadows, Culbertson (B 4441).

4a. **Eriogonum nudum** var. **scapigerum** Jepson *l.c.*

E. scapigerum Eastwood, Proc. Calif. Acad., III, vol. 2, p. 286. 1902.

Type locality.—"Harrison's Pass above timber line, at an elevation of almost 14,000 feet." Tulare County.

Range.—Sierra Nevada in the alpine region.

Zone.—Arctic-alpine.

Specimens examined.—Mt. Goddard, 10,000 feet, Hall and Chandler 662; Mineral King, Tulare County, Brandegee, July 28, 1892; Mt. Silliman, Tulare County, 9,500 feet, Mrs. Brandegee, August 22, 1895; Cirque Peak, Tulare County, at timber line, Hall and Babcock 5504; rocky mountains along Little Kern River, Tulare County, 10–11,000 feet, Purpus 5201; gravelly slopes about Whitney meadows, 11–12,000 feet, Purpus 1559.

While for reasons of convenience it is probably well to accept these varieties, it must be understood that neither has any definite character by which it may always be recognized, in other words they exactly conform to the concept of an *ecological* species, whose characters are directly dependent upon the environment. *E. nudum* Dougl. is one of the commonest Eriogonums and it is easily possible in any large collection to so arrange the suites that undoubted representatives of the type are seen to pass by small differences into these high mountain forms.

5. **Eriogonum ovalifolium** Nutt., Jour. Acad. Philad., vol. 7, p. 50. 1834.

Type locality.—"Sources of the Missouri."

Range.—British Columbia and Alberta south to the Sierra Nevada and along the Rocky Mountains to New Mexico.

Zone.—Upper Sonoran to Hudsonian in the type form.

Specimens examined.—Mt. Tallac, 9,500 feet, Abrams 4829; summit of Mono Pass, 10,700 feet, R. A. Ware 2628c; Silver Mountain, Hooker and Gray in 1877; Mt. Dana, rockfield on the northwest slope, 12,000 feet, Smiley 727; Mt. Whitney, rocky places, Purpus, August, 1895.

5a. **Eriogonum ovalifolium** var. **nivale** Jones, Contr. W. Coast Bot., vol. 11, p. 8. 1903.

E. nivale Canby, Contr. Nat. Herb., vol. 4, p. 187. 1893.

Type locality.—"At timber-line on a divide northwest of Whitney meadows, Sierra Nevada, Tulare County, California."

Range.—High Sierra Nevada.

Zone.—Arctic-alpine.

Specimens examined.—Mt. Whitney, 12,000 feet, Rothrock 390; Siberian Pass, Tulare County, Hall and Babcock 5481; ascent of Mt. Kaweah, Dudley 211; Mt. Dana, Chesnut and Drew, July 17, 1889; Olancha Peak, Tulare County, 11–12,000 feet, Purpus 2012.

5b. **Eriogonum ovalifolium** var. **vineum** Jepson, l.c., p. 423.

E. vineum Small, Bull. Torr. Bot. Club, vol. 25, p. 45. 1898.

Type locality.—"Mountains of Oregon and California"; specimens cited from the San Bernardino Mountains of southern California, and from the Powder River Mountains of eastern Oregon.

Range.—Oregon to southern California.

Specimens examined.—Dick's Peak, Tahoe, 9,950 feet, Smiley 430; Castle Peak, 9,000 feet, Heller 7081.

The var. *vineum* appears worthy of recognition because of the deep red or purple color of the involucres.

Eriogonum rhodanthum Nels. and Kennedy (Proc. Biol. Soc. Wash., vol. 19, p. 35. 1906) is unknown to me in any authentic specimens: by character it seems near if not identical with var. *nivale* Jones; the type locality is "Summit of Mt. Rose, Washoe County, Nevada, elevation 10,800 feet." *Kennedy* 1184.

6. **Eriogonum Kingii** T. and G., Proc. Am. Acad., vol. 8, p. 165. 1870.

E. anemophilum Greene, Pitt., vol. 3, p. 199. 1897.
E. rosensis Nels. and Kennedy, Proc. Biol. Soc. Wash., vol. 19, p. 36. 1906.

Type locality.—East Humboldt Mountains, Nevada.

Range.—Mountains of Nevada and east side of the Sierra Nevada.

Zone.—Arctic-alpine.

Specimen examined.—Mt. Rose, 10,800 feet, Kennedy 1180, co-type of *E. rosensis* and an exact match for Watson's collection, from which *E. Kingii* was described.

7. **Eriogonum Lobbii** T. and G., Proc. Am. Acad., vol. 8, p. 162. 1870.

Type locality.—"High mountain near Donner's Pass in the Sierra Nevada."

Range.—Sierra Nevada and North Coast Ranges on their eastern flank.

Zone.—Canadian.

Specimens examined.—About Summit Station, Heller 7011; Angora Peak, 7,100 feet, Smiley 41; Bierstadt Peak, Tahoe, 7,500 feet, Davy 3226; Sierra County, Lemmon 257; Tuolumne Cañon, Chesnut and Drew, July 25, 1889; Mt. Conness, J. M. Hutchings.

7a. **Eriogonum Lobbii** var. **minus** T. and G., l.c., p. 163; an alpine dwarfed form.

Type locality.—"Upon Silver Mountain in the Sierra Nevada, at the height of 11,000 feet."

Range.—Not known beyond the Sierra Nevada.

Specimen examined.—Silver Mountain, 11,000 feet, in dry soil, Brewer 2049.

8. **Eriogonum umbellatum** Torr., Ann. N. Y. Lyc. Nat. Hist., vol. 2, p. 241. 1828.

E. latum Small, *in* Rydb., Mem. N. Y. Bot. Gard., vol. 1, p. 121. 1900.
E. reclinatum Greene, Pitt., vol. 5, p. 67. 1902.

Type locality.—"Near the Rocky Mountains."

Range.—Western United States.

Zone.—Arid Transition to Hudsonian.

Specimens examined.—Pyramid Peak, 9,400 feet, Hall and Chandler 4735; Donner Pass, Heller 7023; Silver Lake, 8,000 feet, Hansen 188; Mt. Bradley, Miss Lathrop, July 25, 1903; Lake Valley, Tahoe, 6,500 feet, Abrams 4811; Mt. Tallac, low mats, 9,100 feet, Smiley 232; Mt. Rose, 9,300 feet, Heller 10,349; about Marlette Lake, east of Tahoe, 2,460 m., Baker 1291; high ridge above Donner Pass, 8,500 feet, Heller, August 17, 1903; Lake Tenaya, Yosemite, 8,600 feet, Smiley 686; Angora Peak, Tahoe, 7,600 feet, Smiley 4; Shuteye Mountain, Madera County, 7,900 feet, Smiley 566; Siberian Pass, Tulare County, Hall and Babcock 5477, this the form of the highest mountains.

Most of the above cited specimens conform to the description of *E. reclinatum*, distinguished from the typical form by the caudex branches more widely spreading but connected with the normal type by all degrees of intergradation.

8a. **Eriogonum umbellatum** Torr. var. **monocephalum** T. and G., Proc. Am. Acad., vol. 8, p. 160. 1870.

E. Tolmieanum Hook., Fl. Bor. Am., vol. 2, p. 134. 1838.

Type locality.—"Banks of the Walla Walla River, among Artemisia."

Range.—Washington to California on the east side of the Cascades-Sierra.

Zone.—Hudsonian as to the specimen cited.

Specimen examined.—Dry soil at Sonora Pass, 10,000 feet, Brewer 1895.

This variety differs from the type in having the umbel reduced to a single ray. Jepson (*l.c.*, p. 425) cites collections from the North Coast ranges.

9. **Eriogonum Torreyanum** Gray, *in* T. and G., Proc. Am. Acad. vol. 8, p. 158. 1870.

Type locality.—"California, on a high mountain of the Sierra Nevada near Donner Pass."

Range.—Sierra Nevada in the Tahoe region.

Zone.—Transition mainly, entering the Canadian.

Specimens examined.—Donner, Kellogg, August 6, 1870; high mountain near Donner Pass, Torrey 443; Sierra Valley, Lemmon in 1873; Mt. Stanford (Castle Peak), Hooker and Gray in 1877.

Scarcely more than a glabrous form of the preceding species; Jones (Contr. W. Coast Bot., vol. 11, p. 5. 1903) has reduced it to varietal rank.

10. **Eriogonum stellatum** Benth., Trans. Linn. Soc., vol. 17, p. 409. 1837.

Type locality.—''Interior of North-west America.''

Range.—Southeast Washington and central Idaho southward to southern California.

Zone.—Transition (Arid) and Canadian.

Specimens examined.—Crescent Lake, Mariposa County, Congdon, August, 1889; Snow Creek, Yosemite, gravelly ridges, 6,600 feet, Hall 9216; Glacier Point, Yosemite, Canby, August 15, 1895.

11. **Eriogonum ursinum** Wats., Proc. Am. Acad., vol. 10, p. 347. 1875.

Type locality.—''Plumas County, California, by Mrs. M. E. P. Ames and J. G. Lemmon, in Long and Bear Valleys, apparently abundant.''

Range.—Northern Sierra and in the Coast Ranges.

Zone.—Transition, entering the Canadian.

Specimens examined.—Cisco, Kellogg, June 15, 1870; summit back of Jonesville, Butte County, 7,000 feet, Heller 11666; Summit, Kennedy and Doten 236; mountains south of Summit Station, 8,000 feet, C. F. Sonne, September 2, 1892; Cisco, Miss H. A. Walker 1432.

11a. **Eriogonum ursinum** var. **venosum** S. Stokes, *in* Herb.

This variety has smaller leaves and more slender peduncles than the type, and the rays of the umbel are of very unequal lengths.

Specimen examined.—Mt. Silliman, Tulare County, 9,800 feet, Mrs. Brandegee, August 22, 1905.

12. **Eriogonum incanum** T. and G., Proc. Am. Acad., vol. 8, p. 161. 1870.

Type locality.—''On the Tuolumne River, alt. 8–11,000 feet.''

Range.—Sierra Nevada, mainly in the southern half of the range.

Zone.—Hudsonian and Arctic-alpine.

Specimens examined.—Pyramid Peak, 9,500 feet, Hall and Chandler 4733; Dick's Peak, Tahoe, 8,700 feet, Smiley 426; Snow Valley, Ormsby County, Nevada, 2,460–2,614 m., Baker 1372; near Snow Flat, Yosemite, 8,700 feet, H. M. Evans, July, 1901; Chilnualna trail, Mariposa County, Congdon, August 12, 1895; Cloud's Rest, 9,300 feet, Smiley 514; Peregoy's to Sentinel Dome, Yosemite, 7–8,000 feet, Gray in 1872; Upper Tuolumne, dry places, 8–11,000 feet, Brewer 1699 (type); Mt. Dana, rock field on the northwest side, 11,500 feet, Smiley 723; Tuolumne meadows, 8,600 feet, R. A. Ware 2622c; Lake Tenaya, 8,500 feet, Hall and Babcock 3501; Sentinel Dome, Yosemite, 8,050 feet, Hall 9142; Mt. Dana, Congdon, August 27, 1895; Snow Creek on gravelly ridges, 6,600 feet, Hall 9185; Silver Lake, Amador County, 7,200 feet, E. Mulliken 125; Cloud's Rest, E. R. Drew, July 25, 1887; Mt. Lyell, 11,000 feet, Hall and Babcock 3954; Shuteye Mountain, Madera County, 7,500 feet, J. Murdoch Jr. 2584; Kaiser Crest, Fresno County, 9,300 feet, Smiley 629; Mineral King, Brandegee, July 28, 1892*; Alta Peak, Tulare County, 12,000 feet, G. B. Grant 3365; Mt. Whitney, rocky pine forests, Purpus 1566; rocky mountain slopes, Kaweah meadows, 10–11,100 feet, Purpus 1782; mountains near Farewell Gap, 10,800–11,000 feet, Purpus 2028; Mt. Silliman, Tulare County, 10,000 feet, Mrs. Brandegee, August 22, 1905; near summit of White Chief Peak, Tulare County, Culbertson (B 4427); Mt. Whitney, Dudley 2474; Mt. Kaweah, 12,000 feet, Dudley 2109, 2110; summit of Farewell Gap, 10,500 feet, Dudley 1124; Mt. Goddard, 11,200 feet, Hall and Chandler 696; rocky places on Old Mt. Whitney, 11–12,000 feet, Purpus 2012.*

13. **Eriogonum marifolium** T. and G., Proc. Am. Acad., vol. 8, p. 161. 1870.

E. polypodum Small, Bull. Torr. Bot. Club, vol. 25, p. 46. 1898.

Type locality.—"Mount Shasta, 7–9,000 feet" and "High mountain near Donner's Pass, Sierra Nevada."

Range.—Sierra Nevada.

Zone.—Canadian.

Specimens examined.—Lake Valley, 6,400 feet, Abrams 4771; Glen Alpine, 7,000 feet, W. W. Price, July 12, 1898; Lake Tahoe, 6–8,000 feet, G. B. Grant in 1906; Carson Spur, Alpine County, 8,500 feet, Hansen 1261 (this number in U. C. said to have been collected at Silver Lake); lower end of Donner Lake, Heller 6923; ridge between

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* These two specimens most nearly conform to what I presume is *E. rosulatum* Small (Bull. Torr. Bot. Club, vol. 25, p. 46. 1898), described from *Coville* and *Funston* 1549, which was collected near Mineral King; this form is very feebly distinguished by the filaments being nearly or quite glabrous, these in the type form being more or less hairy.

Lake Lucile and Lake of the Woods, Tahoe, Dudley, June 26, 1900; west side of Slide Mountain, Washoe County, Nevada, 8,600 feet, Heller 10959; head of Galena Creek, Washoe County, 8,500 feet, Heller 9899; Mt. Rose, 9,500 feet, Heller 10220; high peaks above Webber Lake, Lemmon 1202; top of Kettle Mountain Ridge, Fresno County, Dudley, August 23, 1904; Long Meadow, Tulare County, Dr. E. Palmer in 1882 (co-type of *E. polypodum*).

This species is very near the preceding and differs mainly in the looser habit of the caudex; it is very possible that a monographic study of all the species of Eriogonum will result in many changes in the position of the earlier described species, which, with the increase in the number of specimens available for comparison, will appear less easily separable than their extreme forms, the bases for a number of the now accepted species.

2. OXYRIA

1. **Oxyria digyna** (L.) Hill, Hort. Kew., p. 158. 1768.

Rumex digynus L., Sp. Pl., p. 337. 1753.

Type locality.—"Habitat in Alpibus Lapponicis, Helveticis, Wallicis."

Range.—Holarctic realm; in America south to New England, New Mexico, and southern California.

Zone.—Arctic-alpine; rarely in the Hudsonian.

Specimens examined.—Sierra County, Lemmon 720; Hope Valley, Alpine County, 8,000 feet, Hansen 309; Castle Peak, Lemmon; Dick's Peak, Tahoe, 9,700 feet, Smiley 427; summit of Devil's Cliff, Summit, Kennedy and Doten 286; cliffs at Glen Alpine, Tahoe, 7,000 feet (?), McGregor 167; Castle Peak near the highest point, Heller 7097; high mountain near Donner Pass, Torrey 430; Mono Pass, 9,000 feet, R. A. Ware 2614c; Mt. Goddard, 9,700 feet, Hall and Chandler 656; Mt. Dana, H. M. Evans, July, 1901; same locality, 9–10,000 feet, Brewer 1795; above Elizabeth Lake, Yosemite, 10,000 feet, Smiley 807; Kaweah Peaks, Dudley 2443; Mt. Whitney, 13,000 feet, Culbertson (B 4528).

This species is perhaps the most characteristic plant of the Arctic-alpine zone and is very rarely found below tree-line.

3. RUMEX

Flowers perfect in a leafy-bracted compact raceme; leaves abruptly contracted to a winged petiole; callus grains wanting or the sepal merely ridged ....1. **R. hesperius**

Flowers monoecious in slender, loose, leafless racemes; leaves entire, linear, attenuate to a narrow petiole; callus grains minute or wanting ....2. **R. paucifolius**

1. **Rumex hesperius** Greene, Pitt., vol. 4, p. 234. 1901.

R. salicifolius Weinm. var. *montigenitus* Jepson, Fl. Calif., vol. 1, p. 386. 1914.

Type locality.—"Near Bingen, Washington."

Range.—Pacific Coast.

Zone.—Transition to Hudsonian.

Specimens examined.—Carson Spur, Alpine County, 8,500 feet, Hansen 752; Upper Tuolumne River, 9,000 feet, Brewer 1757.

Our high mountain Dock differs from *R. salicifolius* Weinm. (*in* Flora, vol. 4, p. 28. 1821), which was described from "California" in the usually almost complete absence of grains upon the sepals; from *R. Mexicanus* Meissn. it differs, besides lacking the well developed grains of that species, also in the smaller panicle. I have seen no authentic material of *R. subalpinus* Jones (Proc. Calif. Acad. II, vol. 5, p. 720. 1895), which is based upon material collected by Jones (No. 5954) on "Brigham Peak, near Maryville, Utah, 10,800 ft. alt."; from character it would seem to approach *R. mexicanus* Meissn. (*in* DC. Prodr., vol. 14, p. 45. 1856), a species ranging from British America throughout the Rockies to the mountains of central Mexico (see Fernald: "The representatives of *Rumex salicifolius* in Eastern North America": Rhodora, vol. 10, p. 17. 1908).

2. **Rumex paucifolius** Nutt., *in* Wats., Bot. King's Exped., p. 314. 1871.

R. Geyeri (Meissn.) Trel., Rep. Mo. Bot. Gard., vol. 3, p. 78. 1892.
R. Engelmanni var. *Geyeri* Meissn., *in* DC. Prodr., vol. 14, p. 64. 1856.

Type locality.—"Near Flat-Head river, in moist places by streams (Montana)."

Range.—British Columbia south to California and Colorado.

Zone.—Canadian.

Specimens examined.—Soda Springs, Yosemite, Brewer 1696; Tuolumne meadows, 8,600 feet, R. A. Ware 2662c; Yosemite Valley,

J. B. Lembert in 1893; near Fallen Leaf Lake, Tahoe, 6,700 feet, Smiley 298; Mt. Goddard, Yosemite, 10,200 feet, Hall and Chandler 661; trail to Mt. Whitney, Culbertson (B 4371); Bloody Cañon, Mono County, Chesnut and Drew, July 20, 1889; Volcano meadows, Tulare County, Dudley 2499; Funston's Kaweah meadow, Dudley 2196.

4. POLYGONUM

- Leaves (mostly narrow and lanceolate or linear) and bracts jointed upon a very short petiole adnate to the short sheath by the lobed or lacerate stipules; flowers in axillary clusters or crowded into a leafy terminal spike.
  - Small annuals with erect or ascending stems.
    - Flowers erect; stems 1–6 inches high, branched or simple.
      - Leaves ovate or oblong (½ inches or less long), not diminished upwards; flowers distinctly pedicelled in the loose inflorescence ..1. **P. minimum**
      - Leaves linear or narrowly lanceolate (½-1 inch long); flowers sessile or subsessile in the dense inflorescence.
        - Upper leaves obviously reduced, bracteate among the congested flowers; achene black ....2. **P. imbricatum**
        - Upper leaves little, if at all, reduced; achene light brown ....3. **P. Kelloggii**
    - Flowers reflexed and remote; stems ½–1.5 feet high, sparingly branched; leaves 1–1.3 inches long ....4. **P. Douglasii**
  - Perennial with suffrutescent branching prostrate stems and conspicuous broad silvery stipules; flowers red or light pink ....5. **P. shastense**
- Leaves ample, not jointed to the petiole.
  - Flowers in a single dense raceme terminal upon the simple stem; glabrous perennial, ½–2 feet high, of wet meadows ....6. **P. bistortoides**
  - Flowers in panicles or clusters.
    - Leaves 3–6 inches long, glabrous; stems stout, ½–6 feet high, branching.
      - Leaves lanceolate, firm; branching panicle densely many-flowered ....7. **P. alpinum**
      - Leaves ovate, thin; panicle few-flowered ....8. **P. phytolaccaefolium**
    - Leaves ¾–1.5 inches long, ovate, minutely pubescent; stems 4–15 inches high ....9. **P. Davisiae**

1. **Polygonum minimum** Wats., Bot. King's Exped., p. 315. 1871.

Type locality—"Wasatch and Uintah Mountains; 9–11,000 feet altitude."

Range.—Alaska south to the Siskiyou Mountains and central Sierra Nevada and east to Colorado.

Zone.—Canadian.

Specimens examined.—Glen Alpine trail to Mt. Tallac, Dudley, June 28, 1900; Webber Lake, Lemmon 1205; Donner Lake, Brandegee, September, 1888; Gilmore Lake, on west side of Mt. Tallac, Tahoe, 8,600 feet, Smiley 377; Mt. Watkins, Yosemite, 6,900 feet, Hall 9170; near foot of Mt. Silliman, 11,000 feet, Dudley 1513.

2. **Polygonum imbricatum** Nutt., *in* Wats., Am. Nat., vol. 7, p. 665. 1873.

P. Watsoni Small, Monogr. N. Am. Polygonum, p. 138, pl. 56. 1895.

Type locality.—"Frequent in the mountains, alpine and subalpine, from Colorado to Oregon and northern California."

Range.—Washington south to California and east to Colorado.

Zone.—Canadian and Hudsonian.

Specimens examined.—Glen Alpine trail to Mt. Tallac, Dudley, June 28, 1900, in part; Donner Lake, Heller 6929; Twin Lakes, 8,500 feet, Alpine County, Hansen 311; Gilmore Lake on Mt. Tallac, 8,600 feet, Smiley 377; Snow Creek, Yosemite, 6,800 feet, Hall 9187; Silver Mountain, Yosemite, Hooker and Gray in 1877; Rowell meadow, Fresno County, Dudley, August 23, 1904; Kaweah meadow, Tulare County, 7–8,000 feet, Dudley 2197; Cathedral trail to Mt. Tallac, Tahoe, 6,700 feet, Smiley 209; sandy flat near Dark Hole, Tioga Road, Yosemite, 7,600 feet, Smiley 683; Nellie Lake meadow, Fresno County, 8,700 feet, Smiley 608; Round Meadow, Fresno County, 7,100 feet, Smiley 581.

3. **Polygonum Kelloggii** Greene, Fl. Fran., p. 134. 1891.

Type locality.—"Common in the Donner Lake Region of the Sierra."

Range.—California to Wyoming and Colorado, north to Washington and Alberta.

Zone.—Transition and Canadian.

Specimens examined.—Fallen Leaf Lodge, Tahoe, 6,900 feet, Abrams 4873; Lake Tenaya, Yosemite, sandy flats, Smiley 690; Tuolumne meadows, sandy spots along the river, 8,500 feet, Smiley 710.

4. **Polygonum Douglasii** var. **latifolium** Greene, Bull. Calif. Acad., vol. 1, p. 125. 1885.

P. tenue var. *latifolium* Engelm., *in* Wats., Bot. Calif., vol. 2, p. 12. 1880.

Type locality.—Not given.

Range.—Washington and Idaho southward to California, Arizona, and New Mexico.

Zone.—Canadian.

Specimens examined.—Above Summit, Smiley 438; Caple's Lakes, Alpine County, 8,500 feet, Hansen 753; lower end of Donner Lake, Heller 6892; foot of Angora Peak, Tahoe, 6,400 feet, Smiley 306;

Red Mountain Lake, near Black Mountain, Fresno County, 9,700 feet, Hall and Chandler 734; Round meadow, Fresno County, 7,000 feet, Smiley 577; Coyote Creek, Tulare County, Culbertson (B 4391); Glacier Point, Yosemite, 7,200 feet, Hall 9151.

The type species, *P. Douglasii* Greene (*l.c.*, p. 125), occurs in the Transition zone in the drier meadows.

5. **Polygonum shastense** Brewer, *in* Gray, Proc. Am. Acad., vol. 8, p. 400. 1872.

Type locality.—"Sierra Nevada in exposed places on dry ashy soil, Mt. Shasta to Carson Pass."

Range.—Sierra Nevada.

Zone.—Arctic-alpine and occasionally in the Hudsonian.

Specimens examined.—Webber and Castle Peaks, Lemmon 1201; high mountain near Donner Pass, Torrey 425; Mt. Stanford (Castle Peak), Sonne, July 26, 1886; Tinker's Knob, Tahoe, 9,500 feet, Sonne, August 23, 1885; Pyramid Peak, 9,200 feet, Hall and Chandler 4744; Mt. Rose, 10,000 feet, Kennedy 1137; ridge above Donner Pass, 8,500 feet, Heller 7151; Wood's Peak, 9,000 feet, Brewer 2111; slope above Desolation Valley on trail to Heather Lake, Tahoe, 8,800 feet, Smiley 336; Mt. Goddard, 11,100 feet, Hall and Chandler 684; Mt. Gibbs, Yosemite, 10,900 feet, Smiley 771; Long meadow, Tuolumne County, Chesnut and Drew, July 14, 1889; Mt. Silliman, Tulare County, Mrs. Brandegee, August 21, 1905.

6. **Polygonum bistortoides** Pursh., Fl., vol. 1, p. 271. 1814.

P. glastifolium Greene, Pitt., vol. 5, p. 199. 1903.
P. cephalophorum Greene, *l.c.*, p. 198. 1903.
Bistorta leptophylla Greene, Leaflets, vol. 1, p. 20. 1904.
Bistorta scaberula Greene, *l.c.*, p. 77. 1904.

Type locality.—"In low grounds on the banks of the Missouri, called Quamash-flats." (Collected in Idaho.)

Range.—In western North America from the subarctic regions south to California, Arizona, and New Mexico.

Zone.—Canadian and in dwarfed forms to above timber line.

Specimens examined.—Pyramid Peak, 8–9,000 feet, Brewer 2137; Caple's Lakes, 8,500 feet, Hanson 315; Marlette Lake, east of Lake Tahoe, 8,000 feet, Hall and Chandler 4581; Lake of the Woods meadow, Tahoe, 8,000 feet, Smiley 48; Tenaya trail from Snow Creek, Yosemite, 7,600 feet, Smiley 671; near Porcupine Flat, Mariposa County, 8,000 feet, R. A. Ware 2620c; Upper Tuolumne River, 8–9,000 feet, Brewer 1786; Elizabeth Lake meadow, Tuolumne meadows, 9,800 feet, Smiley 803; Tenaya meadow, Yosemite, 8,300 feet, Smiley 683; Mt. Raymond, wet meadow on the south side, 7,900 feet, Smiley 534; Kaweah meadow, Tulare County, Dudley 2199; Hockett meadows, Tulare County, 8,500 feet, H. M. and G. R. Hall 8472.

This is the most conspicuous plant in the wet meadows of the Canadian zone; at the higher levels the whole plant becomes very much reduced in size, the spikes scarcely one-half inch long.

7. **Polygonum alpinum** All., Fl. Pedem., vol. 2, p. 206, t. 68, fig. 1. 1785.

P. polymorphum var. *alpinum* Ledeb., Fl. Ross., vol. 3, p. 524. 1849.

Type locality.—European.

Range.—In America, south along the west coast to California.

Zone.—Canadian.

Specimens examined.—Silver Lake, Amador County, 8,000 feet, Hansen 314; Grass Lake, Tahoe, 7,200 feet, McGregor 91; Plumas County, Mrs. Austin in 1876; near Lake Tenaya, Hall and Babcock 3635.

8. **Polygonum phytolaccaefolium** Meissn., *in* Small, Bull. Torr. Bot. Club, vol. 19, p. 360. 1892.

Type locality.—California.

Range.—California to Washington and Idaho.

Zone.—Canadian mainly as to our specimens.

Specimens examined.—Donner Pass, Torrey 425; Donner, K. C. (Mrs. Curran), August, 1883; above Donner Lake toward Donner Pass, Heller 7123.

Perhaps not specifically distinct from the preceding.

9. **Polygonum Davisiae** Brewer *in* Gray, Proc. Am. Acad., vol. 8, p. 399. 1872.

Type locality.—"In California it belongs to the Sierra Nevada."

Range.—North Coast Ranges and northern Sierra.

Zone.—Hudsonian and Canadian.

Specimens examined.—Mt. Dyer, Plumas County, Mrs. Austin in 1879; Sierra County, Lemmon 714; Placer County, A. M. Carpenter, August, 1892; Silver Valley, Alpine County, Brewer 1955; Castle Peak, 7,600 feet, Smiley 469; Mt. Lola, Kennedy and Doten 172; Cisco, high mountains, Bolander in 1872.

P. Newberryi Small (Bull. Torr. Bot. Club, vol. 21, p. 170. 1894), of the Cascades of Oregon and Washington, is a close ally if it be really separable.

Monolepis spathulata Gray (Proc. Am. Acad., vol. 7, p. 389. 1867), though described from "Sierra Nevada, at Mono Pass," a station within our limits, is really an Upper Sonoran and Arid Transition species (Chenopodiaceae).

Abronia alpina Brandegee (Bot. Gaz., vol. 27, p. 456. 1899), with type locality "in Monatchy meadows of Mt. Whitney, at an elevation of 7000–8000 ft., and at Templeton near the craters, growing in loose granite sand," based upon *Purpus* 1877, 1497, is not uncommon about the borders of meadows in the Sierra of Tulare County (edges of Ramshaw meadows, Canadian, 8,700 feet, H. M. and G. R. Hall 8412; sandy plains, Wenatchie meadows, 7–8,000 feet, Purpus 1877) and has been collected within the boreal region, though belonging to a family (Nyctaginaceae) of southern affinities. It is perhaps of some interest to note that another species of Abronia (*A. micrantha* Gray) similarly rises to the border of the boreal region of the mountains of Colorado.

21. CARYOPHYLLACEAE (Pink Family)

- Calyx gamosepalous, forming a tube .... 1. **Silene**
- Calyx with sepals free or united only at base.
  - Petals entire or merely notched, rarely none.
    - Styles 4 or 5, alternate with the sepals .... 2. **Sagina**
    - Styles usually 3, opposite the sepals .... 3. **Arenaria**
  - Petals bifid or lobed, rarely none.
    - Styles usually 3; capsule short .... 4. **Stellaria**
    - Styles 4 or 5; capsule elongated .... 5. **Cerastium**

1. SILENE

- Flowers nodding with stamens and styles long-exserted .... 1. **S. Bridgesii**
- Flowers erect with stamens and styles included or little exserted.
  - Petals without appendages or auricles; calyx cleft to the middle or below .... 2. **S. aperta**
  - Petals with appendages, sometimes auricled; calyx cleft only for ⅓ its length.
    - Stems and foliage glandular-puberulent; densely caespitose with stems 3–10 inches high and with usually a single terminal flower .... 3. **S. Watsoni**
    - Stems and foliage puberulent or glabrous, never glandular; stems 10–24 inches high and usually several (3–5) flowered .... 4. **S. Douglasii**

1. **Silene Bridgesii** Rohrb., App. Ind. Sem. Berol., p. 5. 1867. Monogr. Gatt. *Silene,* p. 204. 1868.

S. incompta Gray, Proc. Am. Acad., vol. 7, p. 330. 1868.

Type locality.—"California, *Bridges.*"

Range.—Sierra Nevada southward from Lake Tahoe.

Zone.—Transition, rising into the Canadian.

Specimens examined.—Mariposa County, Snow Flat, Congdon in 1895; same locailty, 8,700 feet, H. M. Evans, July, 1901; Mt. Bullion, Mariposa County, Congdon in 1893.

2. **Silene aperta** Greene, Leaflets, vol. 1, p. 75. 1904.

Type locality.—''Hockett's Meadows (Tulare County), at 8600 feet.''

Range.—Southern Sierra Nevada.

Zone.—Canadian.

Specimens examined.—Hockett's meadows, Culbertson (B 4498) co-type; same locality, 8,500 feet, Hall and Babcock 5638; four miles south from Hockett's meadows, 9,000 feet, H. M. and G. R. Hall 8478.

This is the ''*S. aptera*'' of Jepson, Fl. Calif., vol. 1, pt. V, p. 506. 1914.

3. **Silene Watsoni** Robinson, Proc. Am. Acad., vol. 28, p. 143. 1893.

Lychnis californica Wats., Proc. Am. Acad., vol. 12, p. 248. 1877, not *Silene californica* Dur.

Type locality.—''In the high Sierra; near Ebbett's Pass.'' Brewer.

Range.—Sierra Nevada to the mountains of southern Oregon.

Zone.—Arctic-alpine.

Specimens examined.—Sierra County, Lemmon in 1875; Long Lake, Plumas County, 6,700 feet, Hall 9349; Mt. Stanford (Castle Peak) Hooker and Gray in 1877; Mt. Rose, 9,650 feet, Heller 9917; near Ebbett's Pass, 9,000 feet, Brewer 2081; Cloud's Rest, summit, Chesnut and Drew, July 13, 1889; Pyramid Peak, Tahoe, west side, 9,800 feet, Hall and Chandler 4720; Mt. Dana, Bolander; same locality, Congdon, August 10, 1898; Mt. Gibbs, Yosemite, 10,500 feet, Smiley 788; Mt. Warren, Lundy trail, Congdon, August 21, 1894; Mt. Goddard, 12,000 feet, Hall and Chandler 675; Dencl's Peak, Tulare County, above timber-line, 10,500–11,000 feet, Hall and Babcock 5515; mountains on Little Kern River, Tulare County, 11–12,000 feet, Purpus 5182; Marble Cañon, Tulare County, Dudley 1277.

Silene Suksdorfii Robinson (Bot. Gaz., vol. 16, p. 44. 1891), a species of the Cascades of Washington and belonging to that group of high montane *Silenes* of which *S. Grayi* Wats. (Proc. Am. Acad., vol. 14, p. 291. 1879) of Mt. Shasta, and *S. Watsoni* are the best defined members, is credited to the Sierra (Mt. Stanford, now called Castle Peak) in the Syn. Fl., vol. 1, pt. 1, p. 222, on the basis of

Hooker and Gray's collection above cited as being of *S. Watsoni*. Dr. Jepson has pointed out how far recent collections have disclosed points of agreement between these species, with the result that the specific lines are now difficult to draw (Jepson, Fl. Calif., vol. 1, pt. V, p. 511). To this same group Miss Eastwood allies her *S. lacustris* (Bot. Gaz., vol. 41, p. 284. 1906), described from "Monarch Lake near Mineral King, Tulare County, California," and stated to be most nearly like *S. Grayi:* no authentic material of this species has been seen by me. What is said by its author to be an outlying member of this alliance, especially related to *S. Watsoni,* is *S. tetonensis* E. Nelson (Bot. Gaz., vol. 30, p. 117. 1900) based upon collections from "high grassy slopes of the Teton mountains," Wyoming, and also collected on Dunraven Peak, Yellowstone Park; it is known to me only from the description as published and maintained by Dr. A. Nelson in the Coulter-Nelson manual.

4. **Silene Douglasii** Hook., Fl. Bor. Am., vol. 1, p. 88. 1830.

Type locality.—"Abundant in mountain valleys, above the Grand Rapids of the Columbia, and among the Rocky Mountains on their western declivity."

Range.—British Columbia south to the Tahoe region through the Cascade-Sierra region; eastward to Montana.

Zone.—Transition and Canadian.

Specimens examined.—Near Cisco, 1,890 m., Hall 8742; south end of Fallen Leaf Lake, Tahoe, 6,500 feet, Hall 8773; Grass Lake, 7,200 feet, McGregor 88; below Camp Agassiz, Tahoe, Dudley, June 27, 1900.

While typical *S. Douglasii* is not usually considered as reaching the Sierra, all collections being as a rule referred to the var. *monantha,* the characters of the specimens above cited seem to require the disposition here given them, at least as to the sheets of these numbers seen by me.

4a. **Silene Douglasii** var. **monantha** (Wats.) Robinson, Proc. Am. Acad., vol. 28, p. 145. 1893.

S. monantha Wats., Proc. Am. Acad., vol. 10, p. 340, 1875.

Type locality.—"On the debris at the base of Castle Rock, Cascades," Washington.

Range.—Washington south to the Tahoe region.

Zone.—Canadian?

Specimens examined.—Cliffs at Webber Lake, Lemmon 3002½; Half-Moon Lake, Tahoe, 8,100 feet, Hall 8823; Angora Peak, Tahoe, east side at 7,500 feet, Smiley 16; near Soda Springs, Jones 2502.

This variety distinguished by the absence of viscid pubescence on the slender, weak stems.

4b. **Silene Douglasii** Hook. var. **macrocalyx** Robinson, Proc. Am. Acad., vol. 28, p. 145. 1893.

Type locality.—"Humboldt Mts., W. Nevada."

Specimen examined.—Mt. Rose, 10,200 feet, Heller 10328, doubtfully referred.

2. SAGINA

1. **Sagina Linnaei** Presl., Rel. Haenk., vol. 2, p. 14. 1835.

Type locality.—Eurasiatic.

Range.—Holarctic realm; in America south on the Pacific Coast from Alaska to mountains of southern California.

Zone.—Transition and above.

Specimens examined.—Webber Lake, Lemmon in 1874; Cloud's Rest, Yosemite, Congdon, August 23, 1890; head of Fall Creek, Ormsby County, Baker 1332.

The Arctic Pearlwort occurs in the Sierra at all elevations above the main forest zone but is nowhere common. Miss Eastwood found it at East Lake, in the high mountains of Tulare County[89] and Merriam[53] reports it as occurring above timber line on Mt. Shasta.

3. ARENARIA

- Pod splitting into 3 entire valves; petals shorter or subequal to the sepals .... 1. **A. Nuttallii**
- Pod splitting into bifid valves; petals longer than the sepals.
  - Densely caespitose alpine; stems ½–3 inches high; leaves minute (¼ inch or less long) and somewhat fleshy .... 2. **A. compacta**
  - Taller subalpine plants; leaves not in the least fleshy.
    - Flowers aggregated into dense clusters, sessile or nearly so 3. **A. congesta**
    - Flowers obviously pedicelled (pedicels ¼–½ inch long) in the open cyme. .... 4. **A. capillaris**

1. **Arenaria Nuttallii** var. **gracilis** Robinson, Proc. Am. Acad., vol. 29, p. 304. 1894.

Type locality.—"California Mts. above Big Tree Grove, *Bolander* 4976; Long meadow, Tulare Co., *Palmer, Coville and Funston.*"

Range.—Sierra Nevada region from the Tahoe region southward to the mountains of southern California.

Zone.—Hudsonian and Arctic-alpine.

Specimens examined.—Mt. Rose, 9,700 feet, Heller 9912; Sonora Pass, 9,000 feet, and top of Silver Mountain, 11,000 feet, Brewer 1879; Mt. Goddard, 11,500 feet, Hall and Chandler 670; mountains above Big Tree Grove (Mariposa Grove), Bolander 4976; Siberian Pass, Tulare County, 3,320 m., Hall and Babcock 5479; Kaiser Peak, 10,200 feet, forming mats, Smiley 643; Harrison's Pass, Tulare County, about 14,000 feet, Eastwood, July 1–13, 1899; Alta meadows, 10,000 feet, G. B. Grant 5318; Mineral King, Brandegee, July 28, 1892; gravelly mountain slopes near Little Kern River, Tulare County, Purpus 5253.

The type form—*A. Nuttallii Pax* (Engler's Jahrb., vol. 18, p. 30. 1893)—is only known in California from the mountains of the Shasta-Siskiyou region and extends north and east to Oregon and Wyoming. The var. *gracilis* differs by the sepals being awned or mucronate and by the green, not glaucous, color.

Var. *gracilipes* Jones (Proc. Calif. Acad. II, vol. 5, p. 626. 1895), which may not be distinct from the variety above cited, but is known to me only by the description, was described from Utah specimens collected on Brigham Peak of the Wasatch above timber line. From character, it differs in the leaves being abruptly pointed, not acuminate as in the type and in var. *gracilis*. Professor Jones cites specimens for the var. *gracilipes* from the Northwest and Wyoming, none from the Californian region.

2. **Arenaria compacta** Coville, Proc. Biol. Soc. Wash., vol. 7, p. 67. 1892.

Type locality.—"At timber-line on a divide northwest of Whitney meadows, Sierra Nevada, Tulare County, California." No. 1653, Death Valley Expedition.

Range.—Southern Sierra Nevada.

Zone.—Arctic-alpine, or rarely in the Hudsonian.

Specimens examined.—Mt. Dana, Theo. Labouchere, July, 1915; near Whitney meadows, Coville and Funston 1653.

3. **Arenaria congesta** Nutt., *in* T. and G., Fl., vol. 1, p. 178. 1838.

Type locality.—"Shady hills in the Rocky Mountain range, about Bear River of the Lake of Timpanagos."

Range.—Pacific Coast south of Washington and east to Colorado and Wyoming.

Zone.—Arid Transition to Hudsonian.

Specimens examined.—Sierra County, Lemmon in 1875; Summit, Bolander 1873; Cisco, Dr. Kellogg, June, 1870; Plumas County, Mrs. R. N. Austin in 1876; Farewell Gap, Tulare County, above timber line, 10,000 feet, Hall and Babcock 5348; rocky mountain slopes near Little Kern River, Tulare County, 9–10,000 feet, Purpus 5263; Mt. Guyot, 10,000 feet, Upper Kern River, Hall and Babcock 5527.

3a. **Arenaria congesta** Nutt. var. **subcongesta** Wats., Bot. Calif., vol. 1, p. 69. 1876.

A. Fendleri var. *subcongesta* Wats., Bot. King's Exped., p. 40. 1871.

Type locality.—"East Humboldt Mountains, Nevada, 7–9,000 feet altitude."

Range.—Same as the species.

Specimens examined.—Castle Peak, Heller 7063; Mono Pass, 10,600 feet, R. A. Ware 2627c; Castle Peak, in rock crevices, 8,600 feet, Smiley 486; Crescent Lake, Mariposa County, Congdon, August 11, 1890; Lake Tenaya, Congdon, August 14, 1894; Shuteye Mountain, Madera County, 7,900 feet, Smiley 564.

This variety lacks the characteristic densely clustered head of flowers found in the type form, the flowers being on more or less long pedicels; in this it approaches *A. capillaris,* but may be distinguished from that species by the thicker, shorter leaves, which are straight, not curving as in *A. capillaris.*

3b. **Arenaria congesta** var. **aculeata** (Wats.) Jones, Proc. Calif. Acad. II, vol. 5, p. 626. 1895.

A. aculeata Wats., Bot. King's Exped., p. 40. 1871.
A. utahensis A. Nels., Bull. Torr. Bot. Club, vol. 28, p. 7. 1899.

Type locality.—"Fremont's Pass, East Humboldt Mountains, Nevada; 6,500 feet altitude."

Range.—Mountains of the Great Basin and west slope of the Rockies in Colorado and Wyoming.

Specimens examined.—Mt. Rose, 9,000 feet, Kennedy 1145; Snow Valley, Ormsby County, 2,460–2,615 m., Baker 1276.

4. **Arenaria capillaris** Poir, *in* Lam. Encycl., vol. 6, p. 380. 1804.

Type locality.—"Dans la Siberie."

Range.—Southeastern Alaska to California and east to Utah.

Zone.—Hudsonian and Arctic-alpine.

Specimens examined.—Pyramid Peak, 9,600 feet, Hall and Chandler 4723; Kaiser Crest, Fresno County, 9,500 feet, Smiley 634; meadows near Black Mountain, Fresno County, 10,000 feet, Hall and Chandler 591; Cloud's Rest, Yosemite, Chesnut and Drew in 1889;

Silver Mountain, 11,000 feet, Brewer 2703; Mt. Surprise, Mariposa County, Congdon, August 11, 1890.

Perhaps most of our collections of this species are best referred to var. *nardifolia* Regel (Bull. Soc. Nat. Mosc., vol. 35, p. 253. 1830), which is distinguished by the acicular leaves curving, rather than straight-leaved.

4. STELLARIA

Bracts of the inflorescence small and scarious.
  Petals minute or none; flowers in umbels .... 1. **S. umbellata**
  Petals longer than the sepals; flowers in terminal cymes (sometimes solitary, the flower then long pedicelled) .... 2. **S. longipes**
Bracts of the inflorescence leafy.
  Leaves lanceolate; flowers cymose .... 3. **S. borealis**
  Leaves ovate, usually crisped on the margins; flowers on long pedicels in the leaf axils .... 4. **S. crispa**

1. **Stellaria umbellata** Turcz., Bull. Soc. Nat. Mosc., p. 89. 1838 (name only); vol. 15, p. 173. 1842, for description.

Alsine baicalensis Coville, Contr. Nat. Herb., vol. 4, p. 70. 1893.

Type locality.—"In alpe Nuchu-Daban," Siberia.

Range.—Rocky Mountains from Montana to New Mexico, west to Oregon and California. San Francisco Mountains, Arizona.

Zone.—Canadian.

Specimens examined.—Peregoys above Yosemite, A. Gray in 1872; soda springs of the Tuolumne, Yosemite, Congdon, August 15, 1894; Tuolumne meadows, Yosemite, 8,500 feet, Smiley 736.

Coville (*l.c.*) reports this rare species from near Mineral King, Tulare County.

2. **Stellaria longipes** Goldie, Edinb. Phil. Jour., vol. 6, p. 327. 1822.

Type locality.—"Woods near Lake Ontario, Canada."

Range.—Ontario to Alaska, south to New Mexico and California.

Zone.—Transition, rising into the Canadian.

Specimens examined.—Plumas County, Mrs. Austin in 1876; Peregoy's, Yosemite, A. Gray in 1872; near Lake Tenaya, 8,000 feet, Smiley 700; Twin Lakes, Alpine County, Hansen 282; subalpine meadows, Mariposa County, Congdon, May, 1888; Tioga Road near Aspen valley, Yosemite, 6,400 feet, Smiley 906; Rowell meadow, Fresno County, Dudley, August 23, 1904; Pitman Creek, Fresno County, 7,000 feet, Smiley 599; Whitney meadows, Tulare County, Coville and Funston 1674; trail to Mt. Whitney, Culbertson (B 4370); South Fork of Kern River, Rothrock 310.

Dr. Jepson (Fl., vol. 1, pt. V, p. 484. 1914) reports the var. *laeta* Wats. (Bibl. Index., p. 112. 1878—*S. laeta* Rich., Franklin's 1st Journ., App. 7, ed. 1, p. 738. 1823, from the Barren Grounds region) from Volcano Creek, Tulare County, *Jepson* 4961, a specimen not seen by me. Culbertson's collection from the high mountains of Tulare County (B 4345), has been assigned by Miss Eastwood to this variety, a reference I consider not justified since the specimen does not show the glaucous color, which is the characteristic differentiating it from the type form.

3. **Stellaria borealis** Bigel. var. **Bongardiana** Fernald, Rhodora, vol. 16, p. 151. 1914.

S. longifolia Bong. Veg. Sitch., p. 126. 1832, not Muhl., *in* Willd., Enum., p. 479. 1809.

Type locality.—Sitka.

Range.—Aleutian Islands to California and appearing in Gaspe Peninsula, Quebec.

Zone.—Canadian.

Specimen examined.—Moist places, Little Tule River, 7–8,000 feet, Purpus 5131.

I have seen no specimens from the Sierra that appeared referable to the type form, though *Jepson* 5003 has been so referred (Jepson, *l.c.*, p. 485).

4. **Stellaria crispa** C. and S., Linnaea, vol. 1, p. 51. 1826.

Type locality.—"Unalaschka."

Range.—Pacific Coast south of Alaska.

Zone.—Transition and Canadian.

Specimens examined.—Mt. Rose, 9,700 feet, Heller 9932; Castle Peak trail, 7,200 feet, deep shaded stream bank, Smiley 460; Funston's meadows, Tulare County, Dudley 2145.

Stellaria Jamesiana Torr. (Ann. Lyc. N. Y., vol. 2, p. 169. 1828) reported by Piper (Fl. Wash.—Contr. Nat. Herb., vol. 11, p. 259) as "Hudsonian," occurs in the mountains of California, both in the Sierra and Coast Ranges, in the Transition life-zone. The only knowledge I have of it as a component of the high mountain flora is the reference to this species by Miss Eastwood[89] of a plant collected at East Lake, Tulare County, by Miss C. E. Wilson. In Idaho its zonal position would seem to be below our limits if one may judge from the collection, *Nelson and Macbride* 1216, made at Ketchum, Blaine County, in a "sunny grassy swale" at 5,887 feet.

5. CERASTIUM

1. **Cerastium arvense** var. **Sonnei** (Greene), comb. nov.

C. Sonnei Greene, Pitt., vol. 4, p. 303. 1901.

Type locality.—"From an altitude of 8,000 feet on Mt. Rose." C. F. Sonne.

Range.—Sierra Nevada.

Zone.—Upper Transition and above.

Specimen examined.—Rosasco's, Tuolumne County, Chesnut and Drew, June 25, 1889.

This variety scarcely merits discrimination were it not for the fact that in the higher mountains the familiar chickweed of the lowlands (*C. arvense* L.) becomes conspicuously more viscid-glandular and with shorter petals and capsules. By these characters the high country plant approaches forms of *C. alpinum* L., especially *C. alpinum* var. *Beeringianum* Regel (Bull. Soc. Nat. Mosc., vol. 35, p. 316). There is preserved in the herbarium of the University of California a fragment of a plant collected by Theo. Labouchère on Mt. Dana, July, 1915, which is probably to be referred to the last named variety. The specimen is, however, so small and immature, the capsule not evident, that definite reference seems at present premature. The variety is known to range from Alaska to New Mexico and Arizona.

22. PORTULACACEAE (PURSLANE FAMILY)

Stamens more than 5 (*L. triphylla* has 4–5 stamens but is recognized by the capsule with circumscissile dehiscence) .... 1. **Lewisia**
Stamens 5 or fewer; capsule with valvular dehiscence.
  Stamens 5; style deeply 3-divided.
    Stems from deep-seated globose corms .... 2. **Claytonia**
    Stems from slender rootstocks .... 3. **Montia**
  Stamens 3; style simple .... 4. **Spraguea**

1. LEWISIA

(All our forms are of the subgenus *Oreobroma*)

Leaves all radical; root fusiform; plants without corms.
  Flowers red, numerous in divaricate panicles on impersistent scapes; leaves much shorter than the scapes .... 1. **L. leana**
  Flowers white on persistent recurving scapes (*L. pygmaea* sometimes has red petals but its leaves always equal and usually exceed the 1- or 2-flowered scapes).
    Sepals obtuse or truncate and glandular-denticulate .... 2. **L. pygmaea**
    Sepals acute, not glandular, and entire .... 3. **L. nevadensis**
Cauline leaves opposite or whorled (2–5); stems from a small globose corm. .... 4. **L. triphylla**

1. **Lewisia leana** Robinson, *in* Gray, Syn. Fl., vol. 1, pt. 1, p. 269. 1897.

Calandrinia Leana Porter, Bot. Gaz., vol. 1, p. 49. 1876.
Oreobroma Leana Howell, Erythea, vol. 1, p. 31. 1893.

Type locality.—"On the Siskiyou Mountains, near the southern boundary of Oregon." L. W. Lee.

Range.—Siskiyou and Salmon Mountains, northwestern California, and southern Sierra Nevada.

Zone.—Canadian.

Specimens examined.—Woodchuck Peak, Fresno County, west slope, 10–11,000 feet, among the first tamarack pines and also above them, G. Eisen; Bald Mountain, Fresno County, 9,000 feet, Hall and Chandler, 398.

A plant collected by *Congdon* on the Hennessey trail, Mariposa County, is referred here by Dr. Jepson (Fl. Calif., vol. 1, pt. V, p. 477), but as represented in U. C. shows some characters unlike *Leana,* as described and presented in the specimens of that species seen by me; in my opinion Congdon's plant is certainly not referable to the type form of *L. Leana,* and is either *L. cotyledon* Robinson (a species certainly known only from northwestern California) or is an undescribed plant; unfortunately the specimen is too fragmentary for critical examination.

2. **Lewisia pygmaea** (A. Gray) Robinson, Syn. Fl., vol. 1, pt. 1, p. 268. 1897.

Talinum pygmaeum Gray, Am. Jour. Sci. II, vol. 23, p. 407. 1862.
Calandrinia pygmaea Gray, Proc. Am. Acad., vol. 8, p. 623. 1873.
Oreobroma pygmaea Howell, Erythea, vol. 1, p. 33. 1893.

Type locality.—"Bridger's Pass," Colorado. Englemann.

Range.—Pacific Coast states east to Montana and Colorado.

Zone.—Hudsonian and Arctic-alpine.

Specimens examined.—Snow Flat, Yosemite, 8,700 feet, Hall and Babcock 5447; Cloud's Rest, in granite sand at 9,850 feet, Smiley 517; foot of Lyell Glacier, Yosemite, Muir in 1872; Yosemite trail, meadows at 8,000 feet, Bolander 6390; Mt. Dana, Chesnut and Drew, July 17, 1889; same locality, 12,200 feet, Hall and Babcock, 3611; Mt. Silliman, Mrs. Brandegee, August 22, 1905; Mineral King, Brandegee, July 28, 1892; mountains near Little Kern River, Tulare County, 11–12,000 feet, Purpus 5681; Glacier Lake, Tulare County, Dudley 1697; north ravine on Mt. Silliman, 11,188 feet, Dudley 1487; above timber line on a mountain north of Whitney meadows, Coville and Funston 1666; near Langley's Camp, Mt. Whitney, Hall and Babcock 5547.

3. **Lewisia nevadensis** (Gray) Robinson, Syn. Fl., vol. 1, pt. 1, p. 268. 1897.

Calandrinia Nevadensis Gray, Proc. Am. Acad., vol. 8, p. 623. 1873.
Oreobroma nevadensis Howell, Erythea, vol. 1, p. 33. 1893.

Type locality.—''Subalpine region of Wahsatch and East Humboldt Mountains,'' and ''Sierra Nevada, California, at Summit and Cisco.''

Range.—Pacific Coast (to southern Sierra Nevada) east to Utah.

Zone.—Canadian.

Specimens examined.—Summit, Bolander, Kellog and Co.; Cisco, Dr. Kellogg in 1870; Diamond Mountain, Plumas County, Mrs. M. E. P. Ames in 1873; near Gold Lake, Sierra County, 6,400 feet, Hall and Babcock 4505; below Donner Lake, wet meadow, Davy 3183; Angora Peak, Tahoe, 8,300 feet, Smiley 23; Cloud's Rest, Yosemite, 8,000 feet, Dudley, June 13, 1894; Funston's meadows, Tulare County, 8–9,000 feet, Dudley 2141; Hockett's meadows, 8,600 feet, Dudley 1879; dry meadows on Middle Tule River, 6–7,000 feet, Purpus 1805.

4. **Lewisia triphylla** (Wats.) Robinson, Syn. Fl., vol. 1, pt. 1, p. 269. 1897.

Claytonia triphylla Wats., Proc. Am. Acad., vol. 10, p. 345. 1875.
Oreobroma triphylla Howell, Erythea, vol. 1, p. 33. 1893.
Erocallis triphylla Rydb., Bull. Torr. Bot. Club, vol. 33, p. 140. 1906.

Type locality.—''Above Cisco, California.'' Watson.

Range.—Washington to California and east to Wyoming and Colorado.

Zone.—Canadian.

Specimens examined.—Gold Lake, Sierra County, 6,400 feet, Hall and Babcock 4506; above Cisco, Watson, July, 1867; same locality, high up, Dr. Kellogg in 1870; Cascade Mountains, Tahoe, 6,225–9,000 feet, Setchell and Dobie, July 6–21, 1901; Angora Peak, Tahoe, M. S. Baker, July 7, 1904; Pyramid Peak, W. S. Atkinson in 1900; Desolation Valley, McGregor 160; Lake Eleanor, Yosemite, Chesnut and Drew, June 28, 1889; meadows near Black Mountain, Fresno County, 10,000 feet, Hall and Chandler B; Nellie Lake meadow, Fresno County, 8,700 feet, Smiley 602; Mt. Silliman, Tulare County, 10,500 feet, Mrs. Brandegee, August 22, 1905; Alta meadows, Tulare County, Mrs. Brandegee, August 4, 1905; woods south of Hockett's meadows, Tulare County, Dudley 1893.

Oreobroma longipetala Piper (Contr. Nat. Herb., vol. 16, p. 207. 1913), described from a plant collected by *Lemmon* in 1875 "in the Sierra Nevada," is unknown to me except by description. It is said to be "intermediate between *O. pygmaea* and *O. oppositifolia* (*L. oppositifolia* Robinson)."

2. CLAYTONIA

1. **Claytonia lanceolata** Pursh., Fl., vol. 1, p. 175. 1814 .

Type locality.—"On the Rocky Mountains."

Range.—British Columbia to California and east to Wyoming.

Zone.—Canadian.

Specimens examined.—Cisco, Dr. Kellogg in 1870; Spanish Peak, Plumas County, 7,000 feet, Hall 9292.

3. MONTIA

Flowering stems scapose, the reduced leaves alternate ....1. **M. parvifolia**
Flowering stems leafy to the top, the leaves opposite ....2. **M. Chamissoi**

1. **Montia parvifolia** Greene, Fl. Fran., p. 181. 1891.

Claytonia parvifolia Mocin., *in* DC. Prodr., vol. 3, p. 361. 1828.
Claytonia filicaulis Hook., Fl. Bor. Am., vol. 1, p. 224, pl. 72. 1834.
Montia obtusata Heller, Muhl., vol. 2, p. 32. 1905.

Type locality.—"In America boreali occid. ad Nootka." Alaska.

Range.—Southeastern Alaska to California and in the northern Rockies.

Zone.—Transition and Canadian.

Specimens examined.—Ridge above Donner Pass, 7,500 feet, Heller 7142; near Glen Alpine, Tahoe, Miss Lathrop, July 19, 1909; Donner Lake, E. L. Greene 465; Glen Alpine, Setchell and Dobie, July 6–21, 1901; Yosemite, Bolander 6376; Gilmore Lake, Mt. Tallac, 8,200 feet, Smiley 370.

2. **Montia Chamissoi** Dur. and Jac., Index Kew Sup., vol. 1, p. 282. 1901.

Claytonia Chamissoi Ledeb., *in* Spreng., Syst., vol. 1, p. 790. 1825.
Claytonia Chamissonia Esch., Linnaea, vol. 6, p. 562. 1831.
Montia chamissonis Greene, Fl. Fran., p. 180. 1891.
Crunocallis chamissonis Rydb., Bull. Torr. Bot. Club, vol. 33, p. 139. 1906.

Type locality.—"Unalaschka."

Range.—Alaska to California and southeastward to Colorado and New Mexico. Also Minnesota.

Zone.—Transition and Canadian, rising rarely into the Hudsonian.

Specimens examined.—Sierra County, Lemmon 27; Soda Springs (Nevada County?), 8,000 feet, Brewer 1707; Iceberg meadow, Alpine County, 6,500 feet, Abrams 4884; Twin Lakes, Alpine County, Hansen 546; above Tallac, Dudley, June 8, 1893; Peregoy's, Yosemite, A. Grey in 1872; Guyot Creek, eastern Tulare County, 10,500 feet, H. M. and G. R. Hall 8429.

4. SPRAGUEA

1. **Spraguea umbellata** Torr., Pl. Frem. Smithson. Contr., vol. 6, p. 4, pl. 1. 1853.

Calyptridium umbellatum Greene, Bull. Torr. Bot. Club, vol. 13, p. 144. 1886.
Calyptridium nudum Greene, Pitt., vol. 1, p. 64. 1887.
Calyptridium monospermum Greene, Erythea, vol. 3, p. 63. 1895.
Spraguea umbellata var. *montana* Jones, Bull. Torr. Bot. Club, vol. 9, p. 31. 1882.

Type locality.—"Forks of the Nozah River, in the foothills of the Sierra Nevada of northern California." (Nozah River, a branch of the Sacramento west of Lassen Peak.)

Range.—California north to British Columbia and east to Wyoming.

Zone.—Transition to Canadian, locally into the Hudsonian.

Specimens examined.—Gold Lake, Sierra County, 6,400 feet, Hall and Babcock 4511; Blue Cañon, Placer County, Miss H. A. Walker 1207; near Summit, Heller 7024; Desolation Valley, Tahoe, 8,200 feet, Smiley 340; Mt. Tallac, summit rocks at 9,700 feet and approaching the following variety, Smiley 269; Mt. Rose, in granite, 9,000 feet, Heller 10,941; Deer Park, Tahoe, E. J. Newcomer in 1909; Pyramid Peak, 9,500 feet, Smiley 93; Glacier Point, Yosemite, Miss Canp, July, 1902; Porcupine Flat, Yosemite, 8,000 feet, R. A. Ware 2692c; Mt. Gibbs, 10,000 feet, Smiley 789; Mt. Silliman, 10,000 feet, Mrs. Brandegee, August 21, 1905; Hockett's meadows, Tulare County, Culbertson (B 4295); dry woods under *P. Murrayana,* 8–9,000 feet, about Funston's meadows, Tulare County, Dudley 2140.

1a. **Spraguea umbellata** Torr. var. **caudicifera** Gray, *in* Patterson, Check List N. Am. Pl., p. 14. 1892.

S. multiceps Howell, Erythea, vol. 1, p. 39. 1893.
Calyptridium umbellatum Greene var. *caudicifera* Jepson, Fl. Calif., vol. 1, p. 465. 1914.

Type locality.—Not ascertained.

Range.—Same as the species.

Zone.—Arctic-alpine.

Specimens examined.—Mt. Dana, rockfield on northwest side, 11,500 feet, Smiley 724; side of Mt. Lyell, 13,000 feet, Lemmon, August 19, 1878; Mt. Goddard, 11,100 feet, Hall and Chandler 679; Olancha Peak, 11–12,000 feet, Purpus 2015.

This variety is well marked in the specimens collected in the rockfields above timber line but gradually acquires the appearance of the typical species lower down, i.e., it is the depauperate alpine form. One of the intergrades is represented by var. *montana* Jones, based on a collection made near "Soda Springs," Nevada County. *C. nudum* Greene has the peduncle simple, the inflorescence being strictly capitate at the top of the 4–5 inch stem; no. 789 from Mt. Gibbs represents this. *C. monospermum* Greene was based on a collection made at Big Cottonwood meadows, Tulare County, 10,500 feet, by F. W. Koch: though described as having two petals and being single-seeded, in the sheet of this collection now in U. C., the flowers have four petals and ovaries and capsules are several seeded.

23. NYMPHAEACEAE (Water Lily Family)

1. NUPHAR

1. **Nuphar polysepalum** Engelm., Trans. St. Louis Acad., vol. 2, p. 282. 1865.

Type locality.—"In small lakes in the higher Rocky Mountains from the sources of the Platte, near Long's Peak, lat. 40°, to those of the Columbia River, lat. 44°."

Range.—Alaska to California and Colorado.

Zone.—Canadian.

Specimens examined.—Suzy Lake trail, Tahoe, 7,500 feet, Smiley 276; same locality, McGregor 179; Tallac Lake, Tahoe, Miss M. S. Haggin; Marlette Lake, east of Tahoe, Baker 1470; Crane Flat, Yosemite, Brewer 1620; Eagle Peak meadows, Yosemite, Hall 9192.

24. RANUNCULACEAE (Buttercup Family)

Apetalous (*Actaea* often has apetalous flowers but may be distinguished by the fruit developing as a berry, not as an achene nor as a follicle).
Leaves divided or deeply lobed; fruit an achene.
Leaves alternate.
Leaves palmately divided into 5–7 lobes; sepals white (petaloid) .... 1. **Trautvetteria**
Leaves 2–3 times ternately compound; sepals herbaceous (not petaloid) .... 2. **Thalictrum**
Leaves opposite or whorled .... 3. **Anemone**
Leaves undivided; fruit a follicle .... 4. **Caltha**
Petals present.
Flowers irregular.
Upper sepal spurred; petals 4 .... 5. **Delphinium**
Upper sepal forming a helmet-shaped hood; petals 2 .... 6. **Aconitum**
Flowers regular.
Flowers with long backward spurs formed by the always 5 petals .... 7. **Aquilegia**
Flowers without spurs; petals indefinite in number, usually more than 5.
Fruit a berry; flowers white .... 8. **Actaea**
Fruit a follicle; flowers dark red .... 9. **Paeonia**
Fruit an achene; flowers yellow .... 10. **Ranunculus**

1. TRAUTVETTERIA

1. **Trautvetteria grandis** Nutt., *in* T. and G., Fl., vol. 1, p. 37. 1838.

Type locality.—"Shady woods of the Oregon."

Range.—Washington and British Columbia south to the northern Sierra Nevada. Also in New Mexico, according to Wooton and Standley.

Zone.—Canadian.

Specimen examined.—Mill Creek, Plumas County, Mrs. R. N. Austin in 1877.

In 1912 Dr. Greene published an article on "New Species of Trautvetteria" (Leaflets, vol. 2, pp. 190–193); among the descriptions is one (p. 191) having as its basis the plant of Mrs. Austin's, the new name being "Trautvetteria rotundata," an exact synonym.

2. THALICTRUM

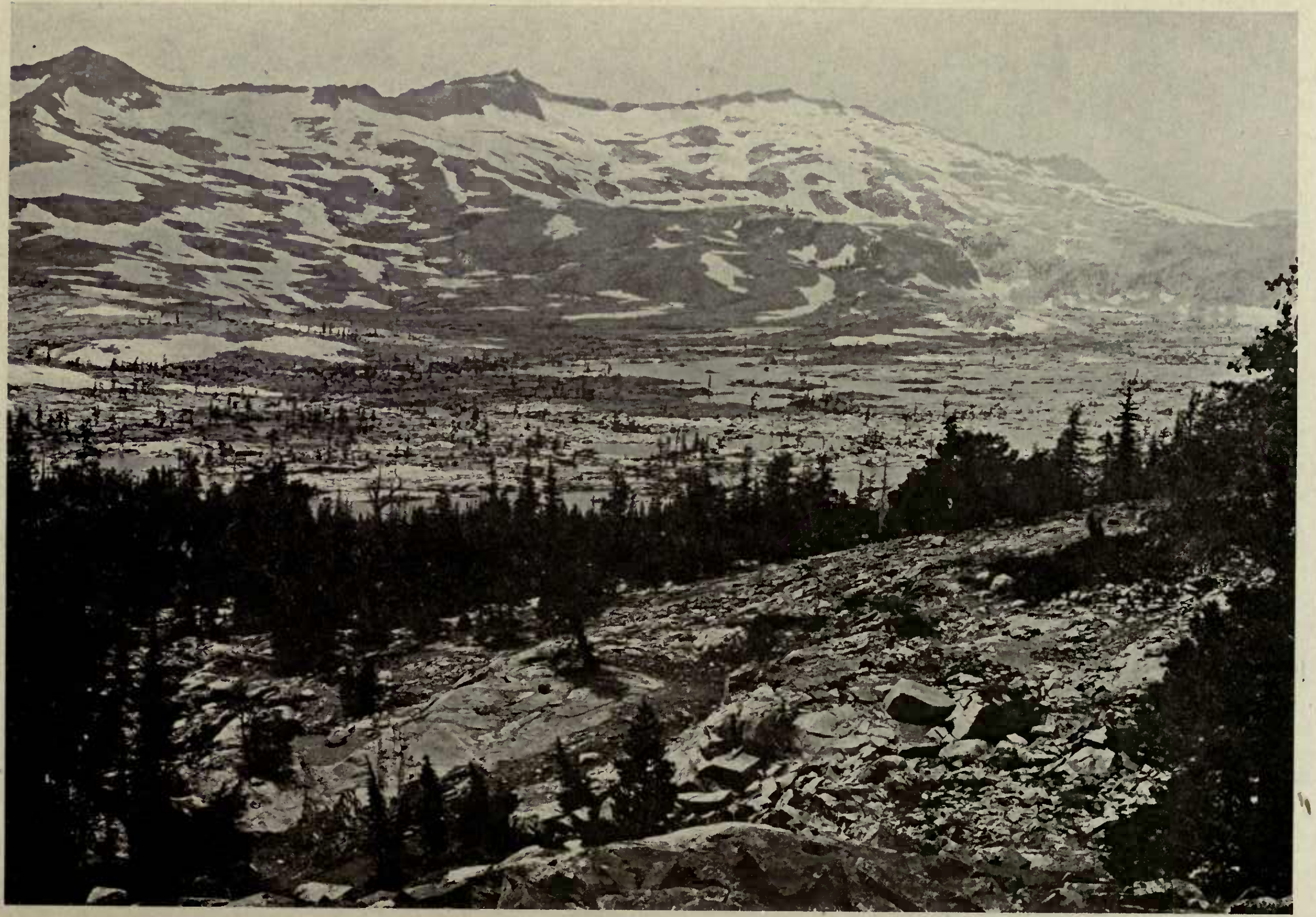
Flowers perfect; upper leaves sessile .... 1. **T. sparsiflorum**
Flowers dioecious or polygamo-dioecious; upper leaves petioled.
Achenes 3/16–1/4 inch long; leaflets firm .... 2. **T. Fendleri**
Achenes 5/16–3/8 inch long; leaflets thin .... 3. **T. occidentale**

1. **Thalictrum sparsiflorum** Turcz., *in* F. and M., Ind Sem. Petrop., vol. 1, p. 40. 1835.

Type locality.—Not ascertained.

Range.—Subarctic America south to California and Colorado.

Zone.—Canadian.



HUDSONIAN AND ARCTIC-ALPINE ZONES, TAHOE REGION: VIEW FROM LUCILE CREST ACROSS DESOLATION VALLEY TO THE PYRAMID PEAK RANGE.

Specimens examined.—Warner Valley, Plumas County, Mrs. Austin in 1879; Truckee River, one mile above Truckee, Heller 7056; Upper San Joaquin River, Madera County, Congdon, August 19, 1895; near Black Mountain, Fresno County, 9,500 feet, Hall and Chandler 614.

2. **Thalictrum Fendleri** var. **platycarpum** Trel., Proc. Bost. Soc. Nat. Hist., vol. 23, p. 304. 1886.

T. hesperium Greene, Pitt., vol. 2, p. 24. 1889.

Type locality.—"California."

Range.—Not known beyond the Sierran region.

Zone.—Transition and Canadian.

Specimens examined.—Donner Lake, C. F. Sonne 16; high Sierra (probably near Summit), Greene 452; Castle Peak trail from Soda Springs, 8,000 feet, Smiley 466; Half-Moon Lake, Tahoe, 8,200 feet, Hall and Chandler 4703; Pyramid Peak, 9,800 feet, Smiley 110; Yosemite Valley and Mono Pass, Bolander 6260; Cloud's Rest, Chesnut and Drew, July 13, 1889; Mt. Raymond, 7,600 feet, Smiley 526; Hockett meadows, Tulare County, Culbertson (B 4381); near Mineral King, Coville and Funston 1387.

3. **Thalictrum occidentale** Gray, Proc. Am. Acad., vol. 8, p. 372. 1872.

Type locality.—"Vancouver's Island."

Range.—Pacific Coast from Alaska to northern California and east to the mountains of Montana and New Mexico.

Specimen examined.—Plumas County, in rocky soil, Mrs. R. N. Austin 166, doubtfully referred since the foliage is thicker than that of the typical form. Aside from this doubtful specimen, no other evidence is at hand that this northern Meadow-rue reaches our limits, except the statement by Greene (Fl. Fran., p. 310) that this species is "frequent in extreme northern Calif., reaching our limits in Sierra Co., at Gold Lake."

Thalictrum alpinum L., present in the high mountain region throughout the Rockies and in arctic America and Eurasia, comes to the borders of our area (White Mountains, Mono County, *Coville and Funston* 1806), but has as yet not been collected in the Sierra or in the other California mountains.

3. ANEMONE

Achenes with long, hairy, persistent styles	1. A. occidentalis
Achenes with short, nearly naked, styles	2. A. Drummondii

1. **Anemone occidentalis** Wats., Proc. Am. Acad., vol. 11, p. 121. 1876.

Pulsatilla occidentalis Freyn, Deutsch., Bot. Monatssch., vol. 8, p. 78. 1890.
Anemone alpina Hook., Fl. Bor. Am., vol. 1, p. 5. 1830, not of L.

Type locality.—"In the mountains, from British Columbia southward to Mt. Shasta and Lassen's Peak."

Range.—British Columbia to southern Sierra Nevada and southeast to northwest Montana.

Zone.—Hudsonian and Arctic-alpine.

Specimens examined.—Nevada County, 7,500 feet, A. M. Carpenter, August-September, 1893; Kaweah River Basin, Tulare County, R. Hopping 72; gravelly mountain slopes above Little Kern River, Tulare County, 10–11,000 feet, Purpus 1813; Sierra Nevada, Dr. G. Eisen (no locality, but probably in Fresno County); slope of Alta Peak, Tulare County, 11,211 feet, Dudley 1530; near Mineral King, Coville and Funston 1531.

2. **Anemone Drummondii** Wats., Bot. Calif., vol. 2, p. 424. 1880.

A. californica Eastw., Proc. Calif. Acad. II, vol. 6, 423. 1896.

Type locality.—"Sierra County," *Lemmon.*

Range.—Alaska to the Tahoe region and through British Columbia to Alberta. Mountains of northern Nevada.

Zone.—Hudsonian.

Specimens examined.—Castle Peak, near the highest point, Heller 7099; Sierra County, Lemmon 703; Mt. Stanford (Castle Peak), 8,500 feet, C. F. Sonne, July 17, 1892; Castle Peak, 8,700 feet, Smiley 481; near Lake Tahoe, Miss Anna King, May, 1900; near Lot's Lake, western Plumas County, Miss Eastwood.

E. Ulbrich, in his monograph,[102] considers this species to be included in *A. Baldensis* L., a disposition of the West American plant with which Dr. Jepson (Fl. Calif., vol. 1, p. 528) concurs; this conclusion I believe erroneous, since as compared with the plant of Eurasia, our species constantly shows narrower leaf segments, shorter leaflet petioles and diminished pubescence. For these reasons, it has seemed to me best to retain *A. Drummondii* as a distinct specific unit, while recognizing its close relationship with the Old World species.

4. CALTHA

1. **Caltha Howellii** Greene, Pitt., vol. 4, p. 79. 1899.

C. biflora Howell, Fl. N.W. Am., vol. 1, p. 20. 1897, not of DC.
C. leptosepala var. *Howellii* E. Huth, Helios, vol. 9, p. 68. 1892.

Type locality.—"Cascade Mountains."

Range.—Sierra Nevada and the southern Cascades and mountains of Siskiyou County.

Zone.—Hudsonian, and not rarely in the Canadian.

Specimens examined.—Plumas County, 7,000 feet, Mrs. Austin, June, 1879; Slide Mountain, Washoe County, Nevada, 8,600 feet, Heller 10960; about Marlette Lake, east of Lake Tahoe, 2,460 m., Baker 1298; Frog Lake, near Castle Peak, C. F. Sonne, July 25, 1886; near Heather Lake, Tahoe, Setchell and Dobie, July 6–21, 1901; Castle Peak, trail from Soda Springs, 7,500 feet, Smiley 462; Pyramid Peak, Tahoe, W. S. Atkinson in 1900; same locality, wet ledge on east side, 9,200 feet, Smiley 127; Peregoy's, above Yosemite, Congdon, June 5, 1897; Cathedral Pass trail, Yosemite, Dudley, July 21, 1901; Cloud's Rest, Brandegee, June, 1883; slopes of Alta Peak, Tulare County, Dudley 1526a; Avalanche meadow, near Mt. Silliman, Tulare County, Dudley 1526; Hockett's meadow, Tulare County, Culbertson (B 4379); Eagle Lake, Tulare County, 10,500 feet, Hall and Babcock 5360; meadows about Alta Lake and Mountain Lake, Tulare County, 9–10,000 feet, Dudley, 990; Hockett's meadows by the river, Tulare County, Dudley 1869.

The acaulescent forms of *Caltha* growing in western alpine or subalpine regions appear to me to be divisible into two groups: the round leaved forms (*C. malvacea* Greene, *l.c.*, p. 75, and *C. Howellii*), and the oblong leaved species (*C. leptosepala* DC., Syst., vol. 1, p. 310; *C. chionophila* Greene, *l.c.*, p. 80, and *C. rotundifolia* Greene, *l.c.*); the first group is strictly west coast, coming south from Oregon to the southern Sierra Nevada; the other alliance belongs to the Rocky Mountains from British Columbia to New Mexico, with outlying species in east Oregon and in the central part of the Great Basin. *C. biflora* DC. (Syst., vol. 1, p. 310) is only found in the northwest from Alaska to Washington.

5. DELPHINIUM

Raceme 1–1.5 feet long, of numerous loosely aggregated long-pedicelled flowers; leaves glabrous and somewhat glaucous; stems 3–6 feet high, stout ....1. **D. glaucum**

Inflorescence loose, few-flowered; leaves green and usually at least pubescent; stems 1–1.5 feet high.

  Sepals much shorter than the slender acuminate spur ....2. **D. pauciflorum**

  Sepals subequal to the thick blunt spur ....3. **D. luporum**

1. **Delphinium glaucum** Wats., Bot. Calif., vol. 2, p. 427. 1880.

D. scopulorum var. *glaucum* Gray, Bot. Gaz., vol. 12, p. 52. 1887.

Type locality.—"In the Sierra Nevada."

Range.—Alaska to California.

Zone.—Canadian.

Specimens examined.—Sierra County, Lemmon in 1874; Webber Lake, Lemmon; Half-Moon Lake, Tahoe, 7,760 feet, McGregor 52; Silver Lake, Amador County, 7,200 feet, E. Mulliken 138; Snow Valley, Ormsby County, Nevada, 2,460–2,615 m., Baker 1371; head of Galena Creek, 8,300 feet, Washoe County, Nevada, Heller 10221.

2. **Delphinium pauciflorum** Nutt., *in* T. and G., Fl., vol. 1, p. 33. 1838.

Type locality.—"Rocky Mountains and Blue Mountains of the Oregon."

Range.—Washington to California and east to Colorado.

Zone.—Canadian, rising into the Hudsonian.

Specimens examined.—Soda Springs, Nevada County, 8,000 feet, Brewer 1785; Hermit Valley, Alpine County, 8,000 feet, Hansen 897; Pyramid Peak, Tahoe, 9,800 feet, Smiley 122; Mt. Tallac, Tahoe, 9,100 feet, Hall-Chandler 4636; Snow Creek, Yosemite, 6,800 feet, Hall 9185; Tioga Road, Yosemite, 9,000 feet, R. A. Ware 2691c.

2a. **Delphinium pauciflorum** var. **Sonnei** (Greene), comb. nov.

D. Sonnei Greene, Pitt., vol. 3, p. 246. 1897.
D. decorum var. *nevadense* Wats., Bot. Calif., vol. 1, p. 11. 1876.

Type locality.—"Near Donner Lake, and also far northward in Siskiyou County," California.

Range.—Mountains of northern and central California.

Zone.—Transition and Canadian.

Specimens examined.—Low ground south end of Donner Lake, Heller 6940; Lake Tahoe, Miss Anna King, May, 1900; Cisco, Bolander in 1873; about Marlette Lake, east of Lake Tahoe, 2,460 m., Baker

1295; King's Cañon, Ormsby County, Nevada, 1,700–2,000 m., Baker 903; meadow above Summit Station, 7,100 feet, Smiley 447; Maggie's Peaks, west of Tahoe, 7,100 feet, Smiley 422; Plumas County, Mrs. Austin in 1879; Independence Lake, 7,000 feet, Hall and Babcock 4529.

This variety seems worthy of recognition because of the broader segments of the thicker leaves than the type form presents. The statement of K. C. Davis[103] that this variant is a "slender weak form" of *D. Andersoni* Gray is certainly wide of the mark; as E. Huth has pointed out,[104] the relationship of the species is with *D. Menziesii* DC.

3. **Delphinium luporum** Greene, Leaflets, vol. 1, p. 76. 1904.

Type locality.—"On Coyote Creek (Tulare County)," California.

Range.—Southern Sierra Nevada.

Zone.—Canadian.

Specimens examined.—Coyote Creek, Tulare County, Culbertson (B 4392); Tioga Road, Yosemite, Congdon, August 15, 1894.

6. ACONITUM

1. **Aconitum columbianum** Nutt., *in* T. and G., Fl., vol. 1, p. 34. 1838.

A. Fischeri Brew. and Wats., Bot. Calif. vol. 1, p. 12. 1876, not of Reichenb.
A. Helleri Greene, *in* Fedde, Rep. nov. spec., vol. 7, p. 3. 1909.
A. Hanseni Greene, *l.c.*
A. obtusiflorum Greene, *l.c.*, p. 4.

Type locality.—"Springy places on the Oregon below Wallawalla." Nuttall.

Range.—Western North America from British Columbia to New Mexico and Arizona.

Zone.—Canadian mainly.

Specimens examined.—Silver Lake, Amador County, 7,200 feet, E. Mulliken 142; Donner Lake, Heller 6917; Fallen Leaf Lake, 6,400 feet, Hall 8833; same locality, Miss Lathrop, July 23, 1909; Half-Moon Lake, 7,760 feet, McGregor 59; Hope Valley, Tahoe region, 8,500 feet, Hansen 557; marshy ravine near Fallen Leaf Lake, Tahoe, 6,800 feet, Smiley 313; Lake Tenaya trail, Yosemite, Congdon, August 14, 1894; Tioga Road near Dark Hole, Yosemite, 7,500 feet, Smiley 876.

7. AQUILEGIA

Flowers pendulous at anthesis, red, with sometimes yellow centers.
  Blades of the petals much reduced or obsolete ....1. A. truncata
  Blades of the petals obvious (¼–½ inch long) ....2. A. formosa
Flowers erect, sulphur-yellow (occasionally white or pinkish) ....3. A. pubescens

1. **Aquilegia truncata** var. **pauciflora** Jepson, Fl. Calif., vol. 1, p. 517. 1914.

A. pauciflora Greene, Leaflets, 176. 1904.

Type locality.—Hockett's meadows,'' Tulare County.

Range.—Sierra Nevada.

Zone.—Canadian, rising locally into the Hudsonian.

Specimens examined.—Pyramid Peak, Tahoe, 9,700 feet, Smiley 122; Castle Peak, 8,400 feet, Smiley 473; Mt. Rose, 9,500 feet, Heller 10336; near summit of Mt. Ralston, Tahoe, 9,100 feet, Hall and Chandler 4681; Lake Tenaya, Yosemite, Brewer 1694; Hockett's meadows, Tulare County, Culbertson (B 4460); Silver Lake, Amador County, 7,200 feet, E. Mulliken 136; Porcupine Flat, Yosemite, 8,000 feet, H. M. Evans, July, 1901.

2. **Aquilegia formosa** Fisch., *in* DC., Prodr., vol. 1, p. 50. 1824.

A. columbiana Rydb., Bull. Torr. Bot. Club, vol. 29, p. 145. 1902.

Type locality.—''In Kamchatka.''

Range.—Northwest coast from the Aleutian Islands to California and Utah.

Zone.—Transition and Canadian, or locally into the Hudsonian.

Specimen examined.—Mono Pass, 10,000 feet, R. A. Ware 2736c.

A. truncata and *A. formosa* constitute a pair of closely allied species with so many characters alike, the reduction of the petals in *A. truncata* differing considerably, that Jones[105] has proposed to regard the first named species as a variety of *A. formosa*.

3. **Aquilegia pubescens** Coville, Contr. Nat. Herb., vol. 4, p. 56. 1893.

Type locality.—''At an altitude of about 3,000 meters in the Sierra Nevada, on a mountain-side north of the White Chief Mine, near Mineral King, Tulare County, California.''

Range.—Central and southern Sierra Nevada.

Zone.—Arctic-alpine.

Specimens examined.—Bloody Cañon, Mono County, Chesnut and Drew, July 20, 1889; Mt. Dana, Congdon, August 10, 1898; Mono Pass, Congdon, August 16, 1894; Mt. Goddard, Yosemite, 12,000 feet, Hall and Chandler 671; Mt. Dana, 10,000 feet, Muir in 1873; Mono

Pass, 11,000 feet, Bolander 6263; Kaiser Peak, Fresno County, 10,100 feet, Smiley 641; near Mineral King, 10,500 feet, J. W. Wright, July 27, 1880; Kern-Kaweah Pass, 9–10,000 feet, Dudley 2376; Rockslide Lake, Kaweah Peaks, 10–11,000 feet, Dudley 2377; Farewell Gap, Tulare Connty, A. Eastwood, July 19, 1903; Alta meadows, Tulare County, R. Hopping 520; just north of the summit of Farewell Gap, Tulare County, 10,300 feet, Dudley 1130; Olancha Mountain, Tulare County, 11,000 feet, Hall and Babcock 5230.

This species is related to *A. chrysantha* Gray and *A. coerulea* James of the high Colorado mountains and represents these species in the alpine flora of the coast.

8. ACTAEA

1. **Actaea spicata** var. **arguta** Torr., Pac. R.R. Rep., vol. 4, p. 63. 1856.

A. arguta Nutt, *in* T. and G., Fl., vol. 1, p. 35. 1838.
A. eburnea Rydb., Mem. N. Y. Bot. Gard., vol. 1, p. 53. 1900.

Type locality.—"Woods of the Oregon and its tributary streams." *Nuttall.*

Range.—Alaska to southern California, east to Alberta and Colorado.

Zone.—Transition and lower Canadian.

Specimens examined.—Glen Alpine, Tahoe, 6,800 feet, McGregor 171; hillside near Tallac, Tahoe, 6,300 feet, Smiley 139; near Whitney meadows, now called Volcano meadows, Tulare County, Coville and Funston 1706; Sequoia National Park, A. Davidson 1965.

I am in doubt if this should be included in this list, since it appears so rarely within our borders and is not common anywhere in the Sierra.

9. PAEONIA

1. **Paeonia Brownii** Dougl., *in* Hook., Fl. Bor. Am., vol. 1, p. 27. 1829.

Type locality.—"Near the confines of perpetual snow, on the subalpine range of Mt. Hood, Northwest America."

Range.—British Columbia and northern Idaho south to Utah and California in both the Sierra Nevada and the Coast Range.

Zone.—Transition and Canadian.

Specimens examined.—Jameson Creek, Plumas County, 6,300 feet, Hall 9307; Nevada County, along base of ridge between Donner Lake and Coldstream, Heller 6954; near Mt. Lola, Tahoe, Dudley, June 19, 1900; near Donner Lake, Dudley, June 7, 1893.

10. RANUNCULUS

Leaves entire ....1. **R. alismaefolius**
Leaves lobed or palmately parted.
  Style stout and sharply recurved or hooked upon the mature achene.
  ....3. **R. oxynotus**
  Style slender subulate and usually straight or loosely coiled ....
  ....2. **R. Eschscholtzii**

1. **Ranunculus alismaefolius** var. **alismellus** Gray, Proc. Am. Acad., vol. 7, p. 328. 1867.

R. alismellus Greene, Fl. Fran., p. 297. 1891.

Type locality.—"Lake Tenaya and on Mount Dana, Sierra Nevada, to the height of 12,000 feet." *Bolander.*

Range.—Pacific Coast from British Columbia to southern California.

Zone.—Canadian and Hudsonian.

Specimens examined.—Webber Lake, Lemmon 1191; Soda Springs, Nevada County, Jones 2485; near Summit, Heller 7010; Caple's Lakes, 8,500 feet, Hansen 554; Twin Lakes, Alpine County, 8,500 feet, Hansen 1306; Pyramid Peak, W. S. Atkinson in 1900; Donner Lake, Dudley, June 7, 1893; Mt. Tallac, near Gilmore Lake, 8,500 feet, Smiley 368; Lake of the Woods meadow, Tahoe, 8,200 feet, Smiley 55; Glen Alpine trail to Mt. Tallac, 9,000 feet, Abrams 4851; Ostrander's, above Yosemite, Bolander 6258; Tuolumne meadows, 8,500 feet, Smiley 735; Lake Tenaya, Yosemite, 8,100 feet, Smiley 687; Dana Fork meadows, Yosemite, at 9,900 feet, Smiley 857; Lake Tenaya to Mt. Dana, 12,000 feet, Brewer 1684; Tuolumne meadows, moist pine forest, 8,000 feet, R. A. Ware 2607c; Snow Valley, Ormsby County, Nevada, 2,460–2,615 m., Baker 1280; near Mineral King, Coville and Funston 1567; Summit Lake, Tulare County, 12,000 feet, Culbertson (B 4351); Hockett's meadows, Tulare County, Culbertson (B 4470); Chagoopa Creek meadows, Tulare County, 10,000 feet, Dudley 2229; meadows near Kaweah Peaks, 12,000 feet, Dudley 2139.

2. **Ranunculus Eschscholtzii** Schlecht., Animad. Ranunc., vol. 2, p. 16. 1820.

Type locality.—"Hab. in insulis Unalaschca et St. Georgii."

Range.—Aleutian Islands to California and in the Rockies to Colorado.

Zone.—Arctic-alpine.

Specimen examined.—Mt. Goddard, 11,000 feet, Hall and Chandler 712.

3. **Ranunculus oxynotus** Gray, Proc. Am. Acad., vol. 10, p. 68. 1874

Type locality.—"California, near summit of Castle Peak, Sierra County, at 9,000 feet." *J. G. Lemmon.*

Range.—Sierra Nevada and mountains of southern California.

Zone.—Arctic-alpine, extending down into the upper Hudsonian.

Specimens examined.—Sierra County, Lemmon 4; Mt. Stanford (Castle Peak), C. F. Sonne, July 17, 1892; Mt. Rose, Nevada, 10,800 feet, Heller 9864; peak above Sonora Pass, Brewer 1907; Cloud's Rest, Congdon, August 23, 1890; Mt. Gibbs, edge of snow bank at 12,100 feet, Smiley 785; Mt. Dana, 11,000 feet, Smiley 721; ridge above Elizabeth Lake, near Tuolumne meadows, 10,100 feet, Smiley 808; Mt. Lyell, 10,300 feet, Hall and Babcock 3561; Wood's Peak, 10–11,000 feet, Brewer 2121; Alta meadows, Tulare County, R. Hopping 515; near Langley's Camp, Mt. Whitney, Hall and Babcock 5546; Farewell Gap, 10,600 feet, Purpus 5669; same locality, 10,500 feet, Dudley 2585; lower slope of Sawtooth Peak, 11–12,000 feet, Dudley 1608; near Mineral King, abundant on a slope, Coville and Funston 1534; summit of Alta Peak, 11,211 feet, Dudley 1537; Olancha Mountain, 10,800–11,800 feet, Hall and Babcock 5232.

This is the characteristic alpine buttercup of the Sierra and frequently the alpine slopes and meadows are brilliantly colored by it.

25. FUMARIACEAE (FUMITORY FAMILY)

Corolla bigibbous, both outer petals spurred and similar ....1. **Dicentra**
Corolla with only 1 petal spurred at base ....2. **Corydalis**

1. DICENTRA

Flowers in a simple racemiform inflorescence.
  Capsule exserted and attenuate into the elongated style; flower about ½ inch long ....1. **D. pauciflora**
  Capsule not exserted and abruptly beaked with the short thick style; flower 1 inch long ....2. **D. uniflora**
Flowers in a thyrsoid inflorescence ....3. **D. formosa**

1. **Dicentra pauciflora** Wats., Bot. Calif., vol. 2, p. 429. 1880.

Diclytra pauciflora Greene, Pitt., vol. 1, p. 187. 1888.
Bikukulla pauciflora (Wats.) Coville, Contr. Nat. Herb., vol. 4, p. 60. 1893.

Type locality.—"Scott Mountains, near snow." *E. L. Greene.*

Range.—Mountains of northern California and in the southern Sierra Nevada.

Zone.—Arctic-alpine?

Specimen examined.—Top of Mt. Moses, Tulare County, 9–10,000 feet, Purpus 1340.

Coville (*l.c.*) reports this from above timber line near the White Chief Mine, above Mineral King, Tulare County.

2. **Dicentra uniflora** Kellogg, Proc. Calif. Acad., vol. 4, p. 141. 1871.

Bikukulla uniflora (Kell.) Howell, Fl. N.W. Am., vol. 1, p. 34. 1897.

Type locality.—"At Cisco and the summit of the Sierra Nevada mountains on the line of the Central Pacific Railroad."

Range.—California to Washington, east to Utah and Wyoming.

Zone.—Canadian and above.

Specimens examined.—Above Independence Lake, Sierra County, 8,000 feet, Hall and Babcock 4536; Cisco, Kellogg and Harford in 1870; Sierra Valley, Lemmon in 1873; Angora Lake and Mt. Tallac, 8,000–8,500 feet, M. S. Baker, July 11, 1904; Elizabeth Lake, Yosemite, edge of snow bank near water, 9,800 feet, Smiley 807a.

Dr. Jepson (Sierra Bull., vol. 8, pp. 266–269. 1912) found this on Macomb Ridge, northeast of Yosemite, at 9,400–9,700 feet.

3. **Dicentra formosa** Walp., Repert. Bot., vol. 1, p. 118. 1842.

Fumaria formosa Andr., Bot. Rep., vol. 6, pl. 393. 1804.
Dielytra formosa DC., Syst., vol. 2, p. 109. 1821.
Dielytra formosa G. Don, Hist. Dichl. Pl., vol. 1, p. 140. 1831.
Dielytra saccata Nutt., *in* T. and G., Fl., vol. 1, p. 67. 1838.
Corydalis formosa Spreng., Syst., vol. 3, p. 162. 1826.

Type locality.—Unknown; described from plants raised from seed.

Range.—Pacific Coast region.

Zone.—Canadian.

Specimens examined.—Alta meadows, Tulare County, Mrs. Brandegee, August 5, 1905; slope of Alta Peak, "one of the commonest plants," Dudley 1551; Hockett's meadows, Dudley 1886; vicinity of Mineral King, 7,800 feet. damp places in shade, Hall and Babcock 5705; Sierra Nevada, 9,000 feet, Brewer 2793.

The collection by Brewer last cited presents a plant with divergent characters of foliage and flowers; the leaf segments are very narrow, incised, the serrations sharply pointed; the petals are not cordate as in the typical form.

2. CORYDALIS

1. **Corydalis Caseana** Gray, Proc. Am. Acad., vol. 10, p. 69. 1874.

C. Bidwelliae Wats., Bot. Calif., vol. 2, p. 429. 1880.

Type locality.—"At the 'Big Spring' in Big Meadows, Plumas Co."

Range.—Northern Sierra Nevada.

Zone.—Transition and Canadian.

Specimens examined.—Jameson Creek, Plumas County, 6,300 feet, Hall 9308.

While our species is a component of the Transition or lowest Canadian floras, the nearly allied *C. Brandegei* Wats. of Utah and western Colorado is distinctly boreal, rising to 11,000 feet in the Wasatch (see Jones, Bot. Gaz., vol. 5, p. 153, as "*C. Caseana*"), and the other species of this group, *C. Cusickii* Wats., of northeastern Oregon and western Idaho, is also high montane.

26. CRUCIFERAE (Mustard Family)

Land plants.
  Pods short (silicles).
    Pods globose .... 1. **Lesquerella**
    Pods flattened parallel to the septum .... 2. **Draba**
    Pods flattened at right angles to the septum .... 3. **Thlaspi**
  Pods long (siliques).
    Pods terete (very slightly compressed in one species of *Erysimum*).
      Leaves simple.
        Flowers large .... 4. **Erysimum**
        Flowers small .... 5. **Barbarea**
      Leaves compound .... 6. **Sisymbrium**
    Pods distinctly flattened parallel to the septum.
      Valves nerveless; leaves all petioled .... 7. **Cardamine**
      Valves 1-nerved; cauline leaves sessile.
        Pods lanceolate with valves obviously reticulate* .... 8. **Parrya**
        Pods linear with valves nearly or quite plane.
          Petals flat .... 9. **Arabis**
          Petals twisted .... 10. **Streptanthus**
Water plant growing submerged; dwarf aquatic .... 11. **Subularia**

1. LESQUERELLA

1. **Lesquerella Kingii** Wats., Proc. Am. Acad., vol. 23, p. 251. 1888.

Vesicaria Kingii Wats., Proc. Am. Acad., vol. 20, p. 353. 1885.

Type locality.—"West Humboldt Mountains, Nevada."

Range.—Eastern Oregon to Nevada and on the east side of the Sierra Nevada to the Tahoe region.

Zone.—Canadian?

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*[*] *Arabis platysperma* might be referred here, but is at once known from our only species of *Parrya*, with dense stellate pubescence, by its glaucous and nearly glabrous foliage.

Specimen examined.—Rocky peak on Truckee River, Placer County, C. F. Sonne, June, 1887, and July, 1886.

2. DRABA

Annuals or biennials 6 inches-1 foot high ....1. **D. stenoloba**
Perennials: dwarf alpines.
Leaf margins revolute.
Leaves distinctly keeled and fascicled at the tips of the caudex branches
....2. **D. oligosperma**
Leaves scarcely carinate, broader and more closely imbricated
....3. **D. glacialis**
Leaf margins flat.
Flowers yellow; stigmas on an evident style.
Pods twisted, usually pubescent; style short and stout ....4. **D. Lemmoni**
Pods straight, glabrous; style slender ....5. **D. eurycarpa**
Flowers white; stigma sessile ....6. **D. Breweri**

1. **Draba stenoloba** Ledeb., Fl. Ross., vol. 1, p. 154. 1841.

Type locality.—"Hab. in ins. Unalaschka."

Range.—Aleutian Islands to California and Colorado.

Zone.—Canadian.

Specimens examined.—Near Summit, Greene 392; Slide Mountain, Washoe County, Nevada, 8,200 feet, Heller 10956; Summit, Jones 2568; Mt. Tallac, Tahoe, meadow on west slope, 8,500 feet, Smiley 372a; Snow Flat, Yosemite, 8,700 feet, Hall and Babcock 3631; Mt. Lyell, 9,000 feet, Hall and Babcock 3553; soda springs, Tuolumne River, Congdon, August 15, 1894; Peregoy's, above Yosemite, A. Gray in 1872; Upper San Joaquin, Congdon, August 19, 1895; near Dinkey Creek, Fresno County, 7,500 feet, Hall and Chandler 396; South Lake, Inyo County, A. Davidson 2727; Cloud's Rest, Chesnut and Drew, July 13, 1889; trail between Mineral King and Farewell Gap, Tulare County, Coville and Funston 1568; Hockett meadows, Tulare County, 8,500 feet, Hall and Babcock, 5625; near Kokops Creek, Kaweah Peaks, Tulare County, Dudley 2413.

2. **Draba oligosperma** Hook., Fl. Bor. Am., vol. 1, p. 51. 1830.

Type locality.—"Summit of limestone hill, Mackenzie River, lat. 68°."

Range.—British Columbia to California and in the Rockies of Montana and northwestern Wyoming.

Zone.—Arctic-alpine.

Specimens examined.—Castle Peak near the highest point, Heller, August 3, 1903; Mt. Lola, Lemmon 1275; Mt. Stanford (Castle Peak), 9,000 feet, C. F. Sonne 2; Pyramid Peak, east side in dry rock, 9,700 feet, Smiley 115; summit of Mt. Dana, Brewer 1735a; same locality, Chesnut and Drew, July 17, 1889; Mt. Gibbs, Yosemite, north side in dry rock crevices, 12,400 feet, Smiley 784; pass between Mts. Dana and Gibbs, Lemmon in 1897.

3. **Draba glacialis** Adams, Mem. Soc. Nat. Mosc., vol. 5, p. 106. 1817.

Type locality.—"In promontorio Byskofskoymys," delta of the Lena River, Siberia.

Range.—Arctic America from Alaska to California and the Rocky Mountains. Northern Asia.

Zone.—Arctic-alpine.

Specimens examined.—Silver Mountain, 11,000 feet, Brewer 2716; Mt. Warren Pass, Tuolumne County, 12,000 feet, Congdon, August 21, 1894; ridge above LeConte Lake, Desolation Valley, Tahoe, in rock crevices, 8,900 feet, Smiley 337; Tinker's Knob, Tahoe, among rocks in dense clumps, 9,000 feet, C. F. Sonne 1.

4. **Draba Lemmoni** Wats., Bot. Calif., vol. 2, p. 430. 1880.

D. alpina var. *algida*, Bot. Calif., vol. 1, p. 29. 1876, for the most part.

Type locality.—"Summit of Mount Lyell, at 13,000 feet altitude."

Range.—Sierra Nevdaa.

Zone.—Arctic-alpine.

Specimens examined.—Mt. Rose, 10–10,800 feet, Kennedy 1154; same locality at 9,000 feet, Heller 10,940; Mt. Dana, summit, Brewer 1735; same locality, F. P. McLean, July, 1875; Mt. Dana, 12,300 feet, Smiley 731; same locality, 12,500–13,050 feet, Hall and Babcock 3606; Mt. Lyell, 13,000 feet, Lemmon, August 19, 1878; same locality, 11,000 feet, Hall and Babcock 3579; pass between Mt. Dana and Mt. Gibbs, 11,000 feet, J. G. Lemmon and wife, September, 1897; Mt. Dana, Congdon, August 27, 1898; Mt. Silliman and Mt. Brewer, 11–13,000 feet, Brewer 2804; near Mt. Whitney, 1650 feet above timber line, V. Bailey 2069; Little Kern River, 11–12,000 feet, Purpus 5118; Mt. Whitney, 15,000 feet, Purpus 2004; at timber line near Mineral King, Coville and Funston 1541; Mt. Guyot, 12,000 feet, H. M. and G. R. Hall 8421; Arroyo-Kern divide, Tulare County, Dudley 2412; Dick's Peak, Tahoe, 10,000 feet, Smiley 432; Mt. Gibbs, Yosemite, 11,500 feet, Smiley 776; Mt. Goddard, Hall and Chandler 668, at 12,000 feet.

5. **Draba eurycarpa** Gray, Proc. Am. Acad., vol. 6, p. 520. 1866.

Type locality.—"On a peak of the Sierra Nevada south of Sonora Pass, alt. 11,500 feet."

Range.—Central and southern Sierra Nevada; central Idaho.

Zone.—Arctic-alpine.

Specimens examined.—Peak near Sonora Pass, 11,500 feet, Brewer 1909; Old Mt. Whitney, 13–14,000 feet, Purpus, August, 1896.

Reported by Miss Eastwood[89] to form mats above timber line, Harrison's Pass, Tulare County.

6. **Draba Breweri** Wats., Proc. Am. Acad., vol. 23, p. 260. 1888.

Type locality.—"On Mt. Dana, at 12,000 feet altitude."

Range.—Central and southern Sierra Nevada. Also on Mt. Shasta, acc. Merriam.

Zone.—Arctic-alpine.

Specimens examined.—Mt. Dana, 12,000 feet, Brewer in 1863; same locality, 12,750–13,050 feet, Hall and Babcock 3605; Mt. Goddard, 13,500 feet, Hall and Chandler 669; mountains near Little Kern River, rocky slopes at 11–12,000 feet, Purpus 5658.

Miss Eastwood[89] found this species in the high mountains of Tulare County, in Kearsarge and Harrison's passes. Merriam reports this species growing on Mt. Shasta at 13,000 feet.[53]

Draba crassifolia Graham (Edinb. New Phil. Jour., 1829, p. 182), a high arctic plant found in Greenland and extending south in the Rockies to Colorado, is attributed to the Sierra (Bot. Calif., vol. 1, p. 28; Greene, Fl. Fran.) upon a collection made at Peregoy's meadows, above the Yosemite Valley, by Dr. Gray in 1872; the immature condition of the specimen really precludes exact determination whether this is *D. crassifolia* or an unusual state of *D. stenoloba;* the altitude at which the collection was made (said on the label in the Gray Herbarium to be 7,000 feet) suggests that it can hardly be same species that is native in Greenland and alpine in the Colorado mountains.

Draba aureola Wats. (Bot. Calif., vol. 2, p. 430. 1880), described from "Sierra Nevada, in Sierra County (*Lemmon*), and on Lassen Peak, *Mrs. Austin,*" does not appear to grow in the Sierra; Lemmon's specimen itself came from Lassen Peak, the reference to Sierra County being, it would appear, an error, at least as to this collection. The species is known to range from Mt. Lassen northward to the mountains of Washington; it is nearly allied to *D. corrugata* Wats. (*l.c.*), an alpine species peculiar to the San Bernardino Mountains of southern California.

3. THLASPI

1. **Thlaspi alpestre** L., Sp. Pl., ed. 2, vol. 2, p. 903. 1763.

Type locality.—"Habitat in Austria."

Range.—Holarctic realm; in America south from British Columbia to California and along the Rockies to Colorado and New Mexico.

Zone.—Canadian and above.

Specimens examined.—Spanish Peak, Plumas County, 6,000 feet, Mrs. R. M. Austin in 1877; same locality, Hall 9287.

Mrs. Austin's specimen shows a certain pallidness in color, a trait that in some plants becomes more pronounced and serves as the basis for "*T. glaucum*" A. Nels., an indefinable variation.

4. ERYSIMUM

Pods slightly compressed and long attenuate to the style ....1. **E. arenicola**
Pods terete or 4-angled, abruptly narrowing to the style ....2. **E. asperum**

1. **Erysimum arenicola** Wats., Proc. Am. Acad., p. 26, vol. 124. 1891.

Type locality.—"In volcanic sand on the Olympic Mountains, Washington, at 5,000 feet altitude."

Range.—Washington to the Sierra Nevada.

Zone.—Arctic-alpine.

Specimens examined.—Mt. Goddard, 11,100 feet, Hall and Chandler 677 in part; Mt. Guyot, Tulare County, 11,500–12,000 feet, H. M. and G. R. Hall 8423.

The reference of these collections to this species involves a very considerable extension of the range of this species, which otherwise is known only from the Cascades, but the flattened pods and long-attenuate beak to the pod are characters inconsistent with the normal habit of the following species or of its variety and are distinctly those of the northern species.

2. **Erysimum asperum** var. **perenne** Wats., *in* Coville, Proc. Biol. Soc. Wash., vol. 7, p. 70. 1892.

Cheiranthes perennis (Wats.) Greene, Pitt., vol. 3, p. 132. 1896.

Type locality.—"Between Mineral King and Farewell Gap, Sierra Nevada, Tulare County, California."

Range.—Sierra Nevada north to central Idaho.

Zone.—Canadian and above.

Specimens examined.—Pyramid Peak, Tahoe, W. S. Atkinson in 1900; Heather Lake, Tahoe, 7,800 feet, McGregor 184; Mt. Tallac, 9,600 feet, Hall and Chandler 4618; Mt. Dana, 12,000 feet, Brewer 1749; Lake Tenaya, Yosemite, Brewer 1689; same locality, 8,100 feet, Smiley 863; Angora Peak, Tahoe, 8,100 feet, Smiley 25; Cloud's Rest, Yosemite, 9,000 feet, Hall 9051; near Nellie Lake, Fresno County, 8,500 feet, Smiley 596; Alta meadows, Tulare County, R. Hopping 146; midway between Mineral King and Farewell Gap, 9,000 feet, Hall and Babcock 5393.

The lemon colored flowers are the main reasons for maintaining this variety distinct from the type; the latter has the corolla orange or even brownish in color and is not found in the mountains above the Yellow Pine belt as a rule.

5. BARBAREA

1. **Barbarea orthoceras** Ledeb., Fl. Ross., vol. 1, p. 114. 1841.

Type locality.—Not ascertained.

Range.—Subarctic America south to northern New England; in the west from the Aleutian Islands to California and Colorado. Siberia.

Zone.—Hudsonian?

Specimens examined.—Lake Tenaya, Yosemite, 8,100 feet, Smiley 866; Mt. Goddard, 11,000 feet, Hall and Chandler, July 24–26, 1900; Mt. Whitney, 11,800 feet, H. M. and G. R. Hall, 8436; along brooks, Farewell Gap, Tulare County, 10,400 feet, Purpus 5241. I have not seen *Coville and Funston* 1403, 1670, but they are quite certainly of this species, as must be the case also of that plant referred to by Miss Eastwood[89] as growing in Harrison's Pass, in the high Southern Sierra.

6. SISYMBRIUM

1. **Sisymbrium incisum** Engelm., *in* Gray, Pl. Fendl., p. 8. 1849.

Type locality.—"Santa Fe Creek and Mora River," New Mexico.

Range.—British Columbia to Manitoba, south to Mexico.

Zone.—Arid Transition and above.

Specimens examined.—Lower end of Donner Lake, Heller 6957; Twin Lakes, Alpine County, Hansen 569; Suzy Lake, Tahoe, 7,500 feet, Smiley 180; Mt. Tallac, 9,500 feet, Hall and Chandler 4609; Mt. Dana, H. M. Evans, July, 1901; same locality, Brewer 1745; Olancha Mountain, Tulare County, common at 8–9,000 feet, Hall and Babcock 5293.

Brewer 1745 is the basis for *Smelowskia? californica* Gray (Proc. Am. Acad., vol. 6, p. 520. 1866), with type locality "On Mount Dana, alt. 10,000 feet, June, in flower; and near Mono Lake, alt. 6,450 feet, July, with young fruit"—indicating about the zonal range of this widely spread species.

The vars. *Sonnei* Robinson and *filipes* Gray appear to be exclusively Transition or lower, at least as to our range.

7. CARDAMINE

Leaves all simple ....1. **C. Lyallii**
Middle cauline leaves pinnate ....2. **C. Breweri**

1. **Cardamine Lyallii** Wats., Proc. Am. Acad., vol. 22, p. 466. 1887.

Type locality.—"Banks of the Ashtnola, Cascade Mountains."

Range.—Southern British Columbia to the central Sierra Nevada (Tahoe) and east to the Clover Mountains, Nevada. According to O. E. Schulz, also in Utah.

Zone.—Transition, rising locally into the Canadian.

Specimens examined.—Along shady streams, Placer County, near Truckee, C. F. Sonne 28; Galena Creek, Washoe County, Nevada, 8,000 feet, P. B. Kennedy.

O. E. Schulz[106] reduces this to a subspecies of *C. cordifolia,* which in the typical form ranges from Idaho to New Mexico.

2. **Cardamine Breweri** Wats., Proc. Am. Acad., vol. 10, p. 339. 1875.

C. orbicularis Greene, Pitt., vol. 4, p. 202. 1901.

Type locality.—"Near Sonora Pass, at 8–10,000 feet altitude." Brewer.

Range.—Pacific Coast south of British Columbia and east to Wyoming and Colorado.

Zone.—Transition and Canadian.

Specimens examined.—Slide Mountain, Washoe County, Nevada, 7,500 feet, Heller 10206; Yuba Pass, Sierra County, 6,500 feet, Hall and Babcock 4518; near Sonora Pass, 8–10,000 feet, Brewer 1890; Volcano Creek, Tulare County, 8,000 feet, Hall and Babcock 5316.

Cardamine bellidifolia L., a high arctic species of circumboreal range, comes to the border of our region as the var. *pachyphylla* Coville (Proc. Biol. Soc. Wash., vol. 11, pp. 169–171. 1897), but is not known south of Lassen Peak, *Mrs. Austin* in 1879.

8. PARRYA

1. **Parrya Menziesii** (Hook.) Greene, Fl. Fran., p. 253. 1891.

Hesperis Menziesii Hook., Fl. Bor. Am., vol. 1, p. 60. 1830.
Phoenicaulis cheiranthoides Nutt., *in* T. and G., Fl., vol. 1, p. 89. 1838.
Phoenicaulis Menziesii Greene, Bull. Torr. Bot. Club, vol. 13, p. 143. 1886.

Type locality.—California.

Range.—California east to Nevada and north to Washington.

Zone.—Arid Transition and Canadian.

Specimens examined.—Fremont Peak, Hy Edward 502; Summit, Kellogg; Castle Peak, near the highest point at 9,000 feet, Heller 7085; high mountain near Donner Pass, Torrey 16; Ebbett's Pass, 8,500 feet, Brewer 1995; King's Cañon, Ormsby County, Nevada, 1,700–2,000 m., Baker 991.

The high mountain form of this species has the basis of the siliques broader and pubescence denser than the lowland form.

9. ARABIS

- Seeds in two rows.
  - Flowers deep purple; stems short (rarely more than 1 foot high); pods usually erect, sometimes reflexed.
    - Sepals glabrous; stems and foliage green or slightly glaucous and nearly glabrous ....1. **A. Lyallii**
    - Sepals pubescent; stems and foliage ashy-pubescent ....2. **A. Lemmoni**
  - Flowers white or pink; stems taller.
    - Mature siliques erect or ascending.
      - Basal leaves glabrous or with a few centrally attached hairs; pods erect or strongly ascending ....3. **A. Drummondii**
      - Basal leaves pubescent with mostly 3-forked stellate hairs; pods divaricate ....4. **A. brachycarpa**
    - Mature siliques sharply reflexed ....5. **A. Holboellii**
- Seeds in one row.
  - Silique stiffly erect, acute; seeds orbicular, broadly winged ....6. **A. platysperma**
  - Siliques recurved, blunt; seeds somewhat wing-margined.
    - Pods pubescent and faintly nerved ....7. **A. repanda**
    - Pods glabrous-shining and distinctly nerved ....8. **A. inamoena**

1. **Arabis Lyallii** Wats., Proc. Am. Acad., vol. 11, p. 122. 1876.

A. Drummondii var. *alpina* Wats., Bot. King's Exped., p. 18. 1871.
A. oreophila Rydb., Bull. Torr. Bot. Club, vol. 34, p. 437. 1907.

Type locality.—"In the mountains from Washington Territory to Mono Pass in the Sierra Nevada and eastward to W. Wyoming and Utah."

Range.—British Columbia to California and northwest Wyoming.

Zone.—Hudsonian.

Specimens examined.—Plumas County, Mrs. Austin in May, 1877; Summit, Jones 2564; Tamarack trail, Tahoe, 8,200 feet, Smiley 271; Pyramid Peak, 9,900 feet, Smiley 118; Suzy Lake, Tahoe, 7,650 feet, McGregor 132; Dog Lake, near Tuolumne meadows, 9,200 feet, Smiley 838; Mineral King, trail from Bullion Flat, 10,500 feet, Dudley 2588; gravelly mountain slopes near Little Kern River, Tulare County, Purpus 1815.

1a. **Arabis Lyallii** var. **Davidsonii** (Greene), comb. nov.

A. Davidsoni Greene, Leaflets, vol. 2, p. 159. 1911.

Type locality.—"Bishop's Creek, Inyo Co., Calif."

Range.—Sierra Nevada only, so far as known.

Zone.—Canadian.

Specimens examined.—Mt. Elwell, Plumas County, 7,800 feet, Mrs. C. M. Wilder, July 11, 1912; below Sabrina Lake, Inyo County, 9,000 feet, Davidson 2728.

This variety differs from the species in the greener, longer petioled leaves upon a stouter, more woody caudex; differences, in my opinion, of distinctly varietal rank.

2. **Arabis Lemmoni** Wats., Proc. Am. Acad., vol. 22, p. 467. 1887.

A. canescens var. *latifolia* Wats., Bot. King's Exped, p. 17. 1871.
A. canescens Brewer and Wats., Bot. Calif., vol. 1, p. 32. 1876.
A. latifolia (S. Wats.) Piper, Contr. Nat. Herb., vol. 11, p. 295. 1906.
A. depauperata Nels. and Kenn., Proc. Biol. Soc. Wash., vol. 19, p. 36. 1906.
A. polyclada Greene, Leaflets, vol. 2, p. 75. 1910.

Type locality.—Not definitely given; the type collection made by Watson in the Clover Mountains of northern Nevada.

Range.—British Columbia to California and northern Wyoming.

Zone.—Arctic-alpine.

Specimens examined.—Mt. Rose, Kennedy 1167 (co-type of *A. depauperata*); Rubicon Peak, Tahoe, 8,000 feet, Smiley 405; Tinker's

Knob, Placer County, C. F. Sonne, July 18, 1897; Mt. Tallac, Tahoe, 9,650 feet, Hall and Chandler 4624; Mt. Warren, Tuolumne County, Congdon, August 24, 1898; Lundy Trail, Yosemite, 12,000 feet, Congdon, August 21, 1894; Cathedral Peak, Yosemite, 9,500 feet, Smiley 814; Kaiser Peak, Fresno County, 10,200 feet, Smiley 644; Farewell Gap at timber line, Coville and Funston 1747; summit of Mt. Dana, Yosemite, Chesnut and Drew, July 17, 1889; mountains near Little Kern River, Tulare County, 9–10,000 feet, Purpus 1819; Farewell Gap, Tulare County, 10,600 feet, Purpus 5229; Milestone Plateau, Kaweah Peaks region, Tulare County, Dudley 2457; Olancha Mountain, 11,500 feet, Hall and Babcock 5229.

3. **Arabis Drummondii** Gray, Proc. Am. Acad., vol. 6, p. 187. 1863.

Turritis stricta Graham, Edinb. New Phil. Jour., 1820, p. 350. 1829.
Streptanthus angustifolius Nutt., *in* T. and G., Fl., vol. 1, p. 76. 1838.
Arabis oxyphylla Greene, Pitt., vol. 4, p. 196. 1900.
Arabis pratincola Greene, Rep. nov. spe., vol. 5, p. 244. 1908.

Type locality.—Rocky Mountains.

Range.—California east to Colorado and northward to British Columbia and Alberta.

Zone.—Canadian.

Specimens examined.—Luther's Pass, near Lake Tahoe, 7,800 feet, Abrams 4763; Spooner, Douglas County, 2,155 m., Baker 1149; Bloody Cañon, Mono County, Congdon, August 14, 1898.

The relationship of this perplexing species to somewhat similar forms in eastern North America is discussed by Fernald[107] who gives as the range of the var. *connexa* (Greene) Fernald, Colorado to Washington and in eastern Quebec, a range common to a very considerable percentage of the floras of the Rockies and the Northwest Coast.

4. **Arabis brachycarpa** Britton, Mem. Torr. Bot. Club, vol. 5, p. 174. 1894.

Turritis brachycarpa T. and G., Fl., vol. 1, p. 79. 1838.
Arabis confinis Wats., Proc. Am. Acad., vol. 22, p. 466. 1887.

Type locality.—"Fort Gratiot, Michigan, and shore of Lake Superior."

Range.—British Columbia to Quebec, south to New Brunswick, New York, Illinois, Colorado, and California (Sierra on the east slope).

Specimens examined.—Near Castle Peak, Heller 7069; Donner Pass, Davy 3184; Collins meadow, Fresno County, 7,000 feet, Hall and Chandler 533, the last not certainly referred.

5. **Arabis Holboellii** Hornem., Fl. Dan., vol. 11, p. 5, pl. 1879. 1827.

Type locality.—"In rupibus Insulae Disco ad Jacobshavn detexit."

Range.—Greenland through subarctic America south to Quebec, Great Lakes, Montana, and California.

Zone.—Canadian.

Specimens examined.—Ralston Peak, Tahoe, 8,300 feet, Smiley 421; Silver Lake, Amador County, 8,000 feet, Hansen 568; Ebbett's Pass, Brewer 2028; Tuolumne meadows, foot of Lamberts Dome, 8,600 feet, Smiley 758; Lake Tenaya trail, Yosemite, Congdon, August 14, 1894; Tuolumne meadows, dry pine forest, 8,600 feet, R. A. Ware 2669c; Indian Creek, Yosemite, 7,300 feet, Hall 9177; divide south side of Slide Mountain, Washoe County, Nevada, 7,600 feet, Heller 10919; sunny mountain slopes above Hockett's meadows, Tulare County, 9–10,000 feet, Purpus 1792; Mt. Lola, south side, Tahoe region, 7,500 feet, Hall and Babcock 4539.

All of the above cited specimens agree excellently with Hornemann's plate save that the stellate pubescence on the sepals is often reduced in amount.

Piper (Fl. Wash.) refers this species to the Arid Transition; in the Sierra, the type form appears to be definitely of the boreal realm though the var. *Fendleri* Wats. is Transition or lower.

Arabis Brucae Jones (Contr. W. Coast Bot., vol. 14, p. 37. 1912), said to be related to the above species and described from "Hills near Davis Creek, Calif., June, 1898, in flower only, part of Mrs. Bruce's No. 225; Summit, Cal., Nevada Co., July 10, 1902, *Jones,*" is unknown to me except from the description, where the characters seem to be inadequate for its separation.

6. **Arabis platysperma** Gray, Proc. Am. Acad., vol. 6, p. 519. 1866.

A. platyloba Greene, Pitt., vol. 4, p. 198. 1900.
A. conferta Greene, Rep. Nov. Spe., vol. 5, p. 243. 1908.
A. densa Greene, Leaflets, vol. 2, p. 76. 1910.
A. paupercula Greene, *l.c.,* p. 77.

Type locality.—"Sierra Nevada, on Mount Dana, alt. 13,227 feet, and above Ebbett's Pass."

Range.—Sierra Nevada northward into southern Oregon (Crater Lake), and Imnaha River region.*

Specimens examined.—Slide Mountain, Washoe County, Nevada, 7,600 feet, Heller 10932; Mount Dyer, Plumas County, Mrs. R. M. Austin, July, 1879; Summit, Bolander in 1873; Desolation Valley, Tahoe, 8,300 feet, Smiley 341; Sonora Pass, 10,000 feet, Brewer 1892; Pyramid Peak, 9,500 feet, Hall and Chandler 4732; Donner Pass, Heller 6975; Silver Lake, Amador County, Hansen 567; Heather Lake, Tahoe, 7,800 feet, McGregor 181; Mt. Rose, 9,650 feet, Heller 9889; Mt. Dana, Brewer 1739b; above Ebbett's Pass, Brewer 1989; at timber line above Mineral King, Coville and Funston 1547; mountain slopes on Little Kern River, 10–11,000 feet, Purpus 5231; trail to Panther Peak, Tulare County, Dudley 1269; Farewell Gap, Tulare County, 10,600 feet, Purpus 5229½.

Hall and Babcock 5465 is a very peculiar form from Volcano meadows, Tulare County, 8,500 feet, with leaves linear-spatulate and pubescence of forked hirsute hairs; it probably represents a species as yet undescribed but whose diagnosis must wait till more material is available.

7. **Arabis repanda** Wats., Proc. Am. Acad., vol. 11, p. 122. 1876.

Type locality.—"Yosemite Valley."

Range.—Sierra Nevada and mountains of southern California.

Zone.—Transition and occasionally above.

Specimens examined.—Near Mineral King, north hillside, 2,750 m., Coville and Funston 1389; open woods near Soda Creek, Tulare County, 8–9,000 feet, Purpus 5276.

8. **Arabis inamoena** Greene, Leaflets, vol. 2, p. 158. 1911.

Type locality.—"Inyo Co., California, at Lake Sabrina."

Range.—Southern Sierra Nevada.

Zone.—Canadian.

Specimens examined.—South Lake, Inyo County, 9,000 feet, A. Davidson 2956; Lake Sabrina, Inyo County, A. Davidson 2729 (cotype); Kaiser Crest, 8,000 feet, Smiley 621.

This species is near No. 7 but appears amply distinct in those specimens seen by me.

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* Acc. Syn. Fl., vol. 1, pt. 1, p. 163, the range extends to Mt. Hood, Oregon, *Howell Bros.*, at the north, East Humboldt Mountains, Nevada, *Watson*, to the east, and to the San Bernardino Mountains, *Parish Bros.*, to the south. The reported extension to Lake Pend d'Oreille, N. Idaho (Holzinger: Sandberg Report) has not been verified.

Arabis Howellii Wats. (Proc. Am. Acad., vol. 25, p. 124. 1890), a species of southern Oregon and also found by Shockley in the White Mountains of Inyo County, is attributed to Mariposa County on a collection of Congdon's (not seen by me) in the Syn. Fl., vol. 1, pt. 1, p. 470; this species resembles *A. platysperma* in appearance but is distinguished by absence of nervation in the valves of the silique. No collections referable to *A. Howellii* have been seen by me from the Sierra Nevada.

Arabis Sabulosa var. *frigida* Jones (Contr. W. Coast Bot., vol. 14, p. 41. 1912), described from ''Top of Diamond Peak (Central Sierra), Cal., June 28, 1897, nearly alpine, *Jones*,'' is unknown to me except from description.

10. STREPTANTHUS

Branches of the inflorescence bearing cordate bracts ....1. **S. tortuosus**
Branches of the inflorescence ebracteate ....2. **S. cordatus**

1. **Streptanthus tortuosus** Kellogg, Proc. Calif. Acad., vol. 2, p. 152, t. 46. 1863.

Type locality.—''From the copper region of the Sierra Nevada Mountains.''

Range.—Sierra Nevada to Mt. Shasta and (according to Syn. Fl.) in the Coast region near Humboldt Bay.

1a. **Streptanthus tortuosus** var. **orbiculatus** Hall., Univ. Calif. Publ. Bot., vol. 4, p. 197. 1912.

S. orbiculatus Greene, Fl. Fran., p. 258. 1891.
S. gracilis Eastwood, Proc. Calif. Acad. III, vol. 2, p. 285. 1902.
Pleiocardia orbiculata Greene, Leaflets, vol. 1, p. 86. 1904.

Type locality.—''Common in the Sierra from Donner Lake northward; also on Mt. Diablo.''

Range.—Sierra Nevada to Mt. Shasta; in the Coast Range, acc. Greene.

Zone.—Canadian to above timber line.

Specimens examined.—Above Donner Lake toward Donner Pass, Heller 7016; Fallen Leaf Trail to Mt. Tallac, 8,500 feet, Abrams 4827; Half-Moon Lake, Tahoe, McGregor 77; glacial valley at base of Pyramid Peak, dry sandy spots, 8,600 feet, Smiley 90; between Suzy and Heather Lakes, Tahoe, 7,600 feet, Smiley 148; Pyramid Peak, W. S. Atkinson in 1900; Silver Lake, Amador County, Hansen 728; Mt.

Tallac, Setchell and Dobie, July, 1901; Pyramid Peak, 9,800 feet, Hall and Chandler 4719; Mono Pass, 10,600 feet, R. A. Ware 2627c; same locality, 11,000 feet, Brewer 1727; trail to Cloud's Rest, 7,400 feet, Smiley 498; Mt. Dana, 10,100 feet, Smiley 713; Tuolumne meadows, dry open gravel, 8,600 feet, R. A. Ware 2666c; Mt. Lyell, 11,000 feet, Hall and Babcock 3586a; soda springs, Tuolumne meadows, 8,680 feet, Brewer 1776; Crescent Lake, Mariposa County, Congdon, August 10, 1890; South Fork of the San Joaquin, 9,800 feet, Hall and Chandler, July, 1900; below Farewell Gap, Tulare County, 10,000 feet, Dudley 2589; timber line near Farewell Gap, 10,000 feet, Hall and Babcock 5661; Mt. Silliman, Mrs. Brandegee, August, 1905; Rubicon Peak, Tahoe, 8,600 feet, Smiley 407.

For a discussion of this form and its relation to the type species, see Hall, *l.c.*, pp. 197–198. The type locality for *S. gracilis* Eastwood is "below timber line on the trail from East Lake to Harrison's Pass," Tulare County: here the ordinary paniculate inflorescence is reduced to a simple few-flowered raceme.

2. **Streptanthus cordatus** Nutt., *in* T. and G, Fl., vol. 1, p. 77. 1838.

S. crassifolius Greene, Pitt., vol. 3, p. 227. 1897.
Cartiera cordata Greene, Leaflets, vol. 1, p. 226, 1906.

Type locality.—"Forests of the Rocky Mountains."

Range.—Colorado and Wyoming west to the east flank of the Sierra Nevada; also in the Tehachapi Mountains, acc. Greene (Fl. Fran., p. 258).

Zone.—Arid Transition and Canadian.

Specimens examined.—Mt. Rose, 10,500 feet, Heller 10,214; Sonora Pass, 10,000 feet, Brewer 1885; Ebbett's Pass, 8,000 feet, Brewer 2028.

At my request, Mr. J. F. Macbride, of the Gray Herbarium, has very kindly reëxamined the material in the Gray Herbarium and confirms the assignment of *Heller* 10214 and *Brewer* 2028 to this species. In regard to the latter number, however, there seems to be a confusion since Dr. H. M. Hall, of the University of California, informs me that the duplicate of this number in the University set of the State Survey's collections contains *Draba Lemmoni*.

11. SUBULARIA

1. **Subularia aquatica** L., Sp. Pl., p. 642. 1753.

Type locality.—"Habitat in Europae borealis inundatis lacustribus fluviis."

Range.—Holarctic realm; in North America south to New England, Wyoming, and California.

Zone.—Canadian.

Specimens examined.—Webber Lake, Lemmon, September 6, 1886; Donner Lake, Brandegee, September, 1888; Summit Valley, mountain lakes, Pringle, September 20, 1882; Mono Pass, Tuolumne River, in pools at 10,000 feet, Bolander in 1866.

Congdon found this at Crescent Lake, Mariposa County.[108]

27. DROSERACEAE (SUNDEW FAMILY)

1. DROSERA

Leaves ⅛–½ inch broad, suborbicular, abruptly contracted to the long hairy petioles .... 1. **D. rotundifolia**
Leaves cuneate-oblong, narrowed to the long petiole very gradually 2. **D. anglica**

1. **Drosera rotundifolia** L., Sp. Pl., p. 281. 1753.

Type locality.—"Habitat in Europae, Asiae, Americae paludibus."

Range.—Holarctic realm; in America south to Alabama along the Appalachian Mountains; in the west to Montana and California.

Zone.—Canadian?, growing in peat bogs or very wet mountain meadows.

Specimens examined.—In wet *Darlingtonia* meadow near the Rainbow Mine, Nevada County, Dudley, June 14, 1893; Sierra County, Lemmon in 1874; Butterfly Valley, Plumas County, in wet meadow (*Darlingtonia dominant plants*), 3,060 feet, Hall 9277; Sieras 2 miles northeast of Dome, Tulare County, 8,000 feet, Brewer, June 24, 1864.

2. **Drosera anglica** Huds., Fl. Angl., p. 135. 1778.

Type locality.—"Habitat in paludosis in comitatibus Westmorlandico, Cumberlandico, Eboracensi, Lancasterensi, Devonensi, Happtoniensi, et Norfolksiensi passim."

Range.—In America, Newfoundland to British Columbia, south to Michigan, north Idaho, and California (northern Sierra Nevada).

Zone.—Canadian?

Specimens examined.—Plumas County, Mrs. R. M. Austin, July 4, 1878; Sierra County, Lemmon 1036.

The inclusion of these two species of sundews in an account of the boreal flora of the Sierra rests upon the fact that they undoubtedly belong to the glacial flora in spite of being now found, within our limits at least, at an altitude considerably below that at which the true boreal flora begins to appear.

Darlingtonia californica Torr. (Smithson. Contr., vol. 6, p. 5, t. 12. 1854), a monotypic genus of *Sarraceniaceae* peculiar to the Californian region, just reaches our lower limits or may rarely rise above them and should be mentioned.

28. CRASSULACEAE (Orpine Family)

1. SEDUM

Stems leafy to the top, the leaves mainly entire; flowers dioecious, the pistillate becoming dark purple, all aggregated into a dense compound terminal cyme .... 1. **S. integrifolium**
Stems with the upper leaves reduced and bract-like, the vegetative leaves radical and entire; flowers yellow, sometimes tinged with red, secund upon the branches of a forked and spreading cyme.
  Petals united for about ¼ their length .... 2. **S. obtusatum**
  Petals free to the base .... 3. **S. yosemitense**

1. **Sedum integrifolium** (Raf.) A. Nels., Coulter and Nelson, new Man., p. 233. 1909.

Rhodiola integrifolia Raf., Atl. Jour., vol. 1, p. 146. 1832.
Sedum frigidum Rydb., Bull. Torr. Bot. Club, vol. 28, p. 282. 1901.
Sedum polygamum Rydb., *l.c.*

Type locality.—"On the Rocky Mountains."

Range.—Alaska and Yukon to California and Colorado, extending into northern New Mexico.

Zone.—Arctic-alpine, rarely in the Hudsonian.

Specimens examined.—Carson Spur, Alpine County, 8,500 feet, Hansen 889; ridge south of Donner Pass, 7,500 feet (?), Heller 7139; Mt. Tallac, W. C. Blasdale, July, 1897; Pyramid Peak, Tahoe, 9,700 feet, Smiley 120; Mono Pass, 10,800–12,000 feet, Brewer 1721; Bloody Cañon, Mono County, 8,500 feet, R. A. Ware 2640c; same locality, Congdon, August 16, 1894; Mt. Rose, 10,000 feet, Kennedy 991; Lambert's Dome, Yosemite, 9,400 feet, R. A. Ware 2701c; Mt. Dana, 13,000 feet, Brewer 1739; saddle between Mt. Dana and Mt. Gibbs, Chesnut and Drew, July 17, 1889; Mt. Dana, 11,800 feet, Hall and Babcock 3620; Mt. Whitney, Culbertson (B 4523); near White Chief Mine, above Mineral King, Tulare County, Coville and Funston 1529; Eagle Lake near Mineral King, 10,500 feet, Hall and Babcock 5365; near

Black Peak, Kaweah Peaks, 12,000 feet, Dudley 2119; Mt. Goddard, 11,000 feet, Hall and Chandler 687; Farewell Gap, 10,500 feet, Dudley 1132; Mt. Dana, 10,400 feet, Smiley 718.

It is very doubtful if this western plant is really separable from the common Rosewort of Europe and northeastern North America; certainly the character indicated by the specific epithet "integrifolium" will not serve to distinguish our Cordilleran form, since the leaves on the same plant vary from entire or repand-dentate to sharply toothed; nor is the assumed difference in color of the flowers to be relied upon.

2. **Sedum obtusatum** Gray, Proc. Am. Acad., vol. 7, p. 342. 1867.

Gormania obtusata (Gray) Britton, Bull. N. Y. Bot. Gard., vol. 3, p. 29. 1903.

Gormania Burnhami Britton, *l.c.*, p. 30.

Type locality.—"Granite rocks in the Sierra Nevada, on Mount Hoffman and above Sonora Pass, *Brewer;* at Vernal Fall in the Yosemite Valley, *Bolander.*"

Range.—Sierra Nevada.

Zone.—Canadian mainly.

Specimens examined.—Lake Tahoe, 6–8,000 feet, G. B. Grant, July 20–August 3, 1906; above Donner Lake toward Donner Pass, Heller 7105; Silver Lake, Amador County, 7,200 feet, E. Mulliken 121; near Glen Alpine in dry floor of *P. Jeffreyi* forest, 7,100 feet, Smiley 378; Angora Peak, Tahoe, 8,300 feet, Smiley 40; Tuolumne meadows, 9,400 feet, crevices on summit of Lambert's Dome, R. A. Ware 2649c; Mt. Hoffman, Yosemite, 10,800 feet, Brewer 1678; below Lake Lucile Ridge, Tahoe, Dudley, June, 1900*; Glen Alpine, Tahoe, 7,000 feet, W. W. Price, July 12, 1898*; summit of Mt. Baldy, 10,000 feet, Tulare County, A. Eaton, July, 1891; Alta Peak, Tulare County, R. Hopping 141; South Fork of the San Joaquin, 7,600 feet, Hall and Chandler 623; Mt. Goddard, 10,000 feet, Hall and Babcock 623.

2a. **Sedum obtusatum** Gray, var. **Hallii** (Britton), comb. nov.

Gormania Hallii Britton, *l.c.*, p. 29.

Type locality.—"Vicinity of Tuolumne meadows, in the Canadian Zone, at 2,800–3,100 m. altitude, Yosemite National Park, California."

Range.—Yosemite region, as yet positively known only from the original station.

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* These specimens have the backs of the petals of a reddish tinge and correspond to the type described as *Gormania Burnhami*; it is not practicable to maintain it even as a form.

Specimens examined.—Vicinity of Tuolumne meadows, 8,500–9,500 feet, Hall and Babcock 3545 (co-type); same locality, 8,700 feet, Smiley 845; Lambert's Rock, Tuolumne meadows, Dudley, July 21, 1901.

The characters relied upon to distinguish this segregate are certainly not of specific grade, unless every depauperate form is to be considered as a species; the character of narrower calyx-lobes than is present in the type is wholly unreal when any considerable series is examined; but the vegetative aspect of the plant is sufficiently different from that of the species to possibly warrant its maintenance as a variety of ecologic significance.

3. **Sedum yosemitense** Britton, Bull. N. Y. Bot. Gard., vol. 3, p. 44. 1903.

Type locality.—"Between Vernal and Nevada Falls."

Range.—Central Sierra Nevada.

Zone.—Arid Transition and rising into the Canadian.

Specimen examined.—Dark Hole, Yosemite Park, 7,750 feet, H. M. Evans, July, 1901.

29. SAXIFRAGACEAE (SAXIFRAGE FAMILY)

- Annual or perennial herbs (*Saxifraga ledifolia* is slightly suffrutescent but known from *Jamesia* by its linear terete leaves; from *Ribes* by 10 stamens).
  - Fertile stamens 5.
    - Staminodia present; carpels 2, distinct; flowers large, usually solitary ....1. **Parnassia**
    - Staminodia absent, all 5 stamens antheriferous; carpels 3–4, united; flowers numerous, clustered.
      - Ovary superior or silghtly attached to the base of the calyx.
        - Stems leafy ....2. **Bolandra**
        - Stems scapose.
          - Petals entire, pinkish or nearly white ....3. **Heuchera**
          - Petals pinnatifid or lobed, greenish ....4. **Mitella**
      - Ovary inferior ....5. **Suksdorfia**
  - Fertile stamens 10.
    - Capsule 1-celled; petals lobed ....6. **Tellima**
    - Capsule 2-celled; petals entire ....7. **Saxifraga**
- Shrubs.
  - Leaves opposite; stamens 10 ....8. **Jamesia**
  - Leaves alternate; stamens 5 ....9. **Ribes**

1. PARNASSIA

1. **Parnassia californica** Greene, Pitt., vol. 2, p. 102. 1890.

P. palustris var. *Californica* Gray, Bot. Calif., vol. 1, p. 202. 1876.

Type locality.—"Wet places in the Sierra Nevada, etc., from Mariposa Co. northward, and on Red Mountain, Mendocino Co. (*Kellogg, Bolander*), chiefly the var. *Californica*."

Range.—Sierra Nevada north to southern Oregon; Coast Ranges (Loma Prieta).

Zone.—Transition and Canadian.

Specimens examined.—Heather Lake, Tahoe, Mrs. Loughead, August 11, 1898; Carson Spur, Alpine County, 8,500 feet, Hansen 723; Heather Lake, Tahoe, 7,800 feet, McGregor 180; Nevada County, 6,900 feet, A. M. Carpenter, August-October, 1892; Crags, Deer Park, Placer County, Miss H. D. Geiss 203; Mt. Dana, Congdon, August 10, 1898; Whitney Creek, Tulare County, Culbertson (B 3860); between Lone Pine and Heather meadow, Tulare County, Dudley 1870, 1872.

2. BOLANDRA

1. **Bolandra californica** Gray, Proc. Am. Acad., vol. 7, p. 341. 1868.

Type locality.—"Yosemite Valley, on the Mariposa trail, among rocks."

Range.—Yosemite region of the central Sierra Nevada.

Zone.—Canadian.

Specimens examined.—Yosemite cliffs, Congdon, June 5, 1897; Tenaya Falls, A. Gray in 1872; Mariposa trail, on rocks, Bolander 4898.

Reported by Hall[101] to grow at 8,400 feet in Stubblefield Cañon, and on the Glacier Point trail at 6,900 feet.

3. HEUCHERA

1. **Heuchera rubescens** Torr., *in* Sitgr., Rep., p. 160. 1854.

H. rubescens var. *glandulosa* Kellogg, Proc. Calif. Acad., vol. 5, p. 45. 1873.
H. lithophila Heller, Muhl., vol. 1, p. 105. 1904.
H. Sitgreavesii Rydb., N. A. Fl., vol. 22, p. 110. 1905.

Type locality.—Not ascertained.

Range.—Rockies of Colorado and New Mexico west to the Sierra Nevada and mountains of southern California; southern Oregon.

Zone.—Arid Transition to Arctic-alpine.

Specimens examined.—Near Summit Station, Heller 7028; Bierstadt Peak, Tahoe, 7,500 feet, Davy 3189; Devil's Cliff, near Summit, Kennedy and Doten 270; Mt. Elwell, Plumas County, 7,800 feet, Hall 9397; Glen Alpine, Tahoe, cliffs at 7,000 feet, McGregor 140; Tamarack trail, Tahoe, 7,200 feet, Smiley 254; Desolation Valley, Tahoe, Setchell and Dobie, July 6–21, 1901; Mt. Stanford (Castle Peak), C. F. Sonne, July 25, 1886; Carson Spur, Alpine County, 8,500 feet, Hansen 713;

Carson Pass, 8,700 feet, Brewer 2101; head of Tuolumne River, 9,000 feet, Brewer 1759; Bloody Cañon, Mono County, 8,500 feet, R. A. Ware 2642c; Cloud's Rest, E. R. Drew, July 25, 1887; Eagle Peak, Yosemite, 7,700 feet, Hall 9195; Mt. Gibbs, dry rocks on west side, 10,200 feet, Smiley 765; Glacier Point, Congdon, July 1, 1885; Volcano Creek, Tulare County, 8,000 feet, Hall and Babcock, 5308; near Mineral King, Coville and Funston 1488; Langley's Camp, Mt. Whitney, 11,700 feet, Hall and Babcock 5549; Mt. Guyot, Tulare County, 12,100 feet, H. M. and G. R. Hall 8422; Mt. Silliman, Tulare County, Mrs. Brandegee, August, 1905.

The high mountain form of this species with a thick woody base was first described by Kellogg as the var. *glandulosa* and the type was "Collected on Stanford Peak, C. P. R.R., at an altitude of 10,000 feet—July 29th, 1870." It is this same form which Heller subsequently described as *H. lithophila.* Seen by itself by one who knows the appearance of typical *H. rubescens,* this subalpine plant appears quite distinct enough to justify its separation but when a large suite of specimens are available for comparison, they are seen to constitute a single specific unit.

4. MITELLA

Petals cuneate, deeply 3-lobed at the apex .... 1. **M. trifida**
Petals pinnatifid with slender segments.
  Stamens opposite the petals, alternate with the sepals .... 2. **M. pentandra**
  Stamens alternate with the petals, opposite the sepals .... 3. **M. Breweri**

1. **Mitella trifida** Graham, Edinb. New Phil. Jour., vol. 7, p. 185. 1829.

Ozomelis pacifica Rydb., N. Am. Fl., vol. 22, p. 95. 1905.

Type locality.—Not given; plants described were raised in England from seed collected by Drummond at some indeterminate locality.

Range.—British Columbia east to Alberta and Saskatchewan, and south to the northern Sierra Nevada.

Zone.—Canadian.

Specimen examined.—Nelson Creek, Plumas County, 5,700 feet, Hall 9357.

2. **Mitella pentandra** Hook., Bot. Mag., vol. 56, pl. 2933. 1829.

Pectiantia pentandra (Hook.) Rydb., N. Am. Fl., vol. 22, p. 93, 1905.
Pectiantia latiflora Rydb., *l.c.*

Type locality.—Not given; plants described were raised in England from seed collected by Drummond in "Rocky Mountains of North America."

Range.—British Columbia and Alberta to southwestern Colorado and through Washington and Oregon to middle California (Tahoe region and Yosemite).

Zone.—Canadian.

Specimens examined.—Snow Valley, Ormsby County, Nevada, 2,460–2,615 m., Baker 1161; Rubico nPeak, Tahoe, Setchell and Dobie, July, 1901; Yuba Pass, 6,500 feet, Hall and Babcock 4482; Long meadow, Tuolumne County, Chesnut and Drew, July 13, 1889; near Marlette Peak, Washoe County, Nevada, 7,500 feet, Hall and Chandler 4571.

3. **Mitella Breweri** Gray, Proc. Am. Acad., vol. 6, p. 533. 1865.

Pectiantia Breweri (Gray) Rydb., N. Am. Fl., vol. 22, p. 93. 1905.

Type locality.—Mount Hoffman in a damp place, at the elevation of about 11,000 feet.''

Range.—British Columbia through north Idaho and Washington to southern Sierra Nevada.

Zone.—Canadian and Hudsonian.

Specimens examined.—Alder Creek near Truckee, Sonne, July, 1893; Lake of the Woods, Tahoe, 8,200 feet, Smiley 57; Tamarack trail, Tahoe, 8,300 feet, Smiley 267; Glen Alpine, W. W. Price, July, 1898; Summit, Kellogg; same locality, Heller 9833; Grass Lake, Tahoe, 7,200 feet, McGregor 97; near Lake Tenaya, Yosemite, 8,000 feet, Smiley 677; near White Wolf, Yosemite, 2,100 feet, Smiley 894; Mt. Hoffman, 11,000 feet, Brewer 1879 (type); near Lake Tenaya, 8,200 feet, Hall and Babcock 3513; Hockett's meadows, Tulare County, Culbertson (B 4395); near Alta Peak, Tulare County, Dudley 1558.

According to Miss Eastwood[89] this grows at East Lake, Tulare County, a station well up in the Hudsonian life-zone.

5. SUKSDORFIA

1. **Suksdorfia ranunculifolia** (Hook.) Engler, *in* E.-P. Nat. Pflanzenf. III, vol. 2a, p. 52. 1891.

Saxifraga ranunculifolia Hook., Fl. Bor. Am., vol. 1, p. 946. 1833.
Hemieva ranunculifolia Raf., Fl. Tell., vol. 2, p. 70. 1836.
Boykinia ranunculifolia Gray, Am. Jour. Sci., vol. 42, p. 21. 1842.

Type locality.—''On the high grounds around the Kettle Falls of the Columbia, and on the Rocky Mountains.''

Range.—British Columbia to the northern Sierra Nevada.

Zone.—Hudsonian?

Specimen examined.—Spanish Peak, Plumas County, Mrs. R. M. Austin, July 7, 1878.

6. TELLIMA

Petals entire; leaves lobate .... 1. **T. scabrella**
Petals cleft into 3–5 lobes; leaves ternate .... 2. **T. bulbifera**

1. **Tellima scabrella** Greene, Pitt., vol. 2, p. 162. 1891.

Lithophragma scabrella Greene, Erythea, vol. 3, p. 102. 1895.

Type locality.—"Pine woods south of Tehachapi, California."

Range.—Sierra Nevada and Tehachapi Mountains.

Zone.—Transition and Canadian.

No specimen of this species has been seen by me from the higher mountains; it is here admitted only because Hall[101] reports that it has been collected on the McClure Fork of the Merced River, in the high Sierra above the Yosemite Valley, at 9,500 feet, and therefore well within our limits.

2. **Tellima bulbifera** (Rydb.) A. Nels., *in* Coulter and Nelson, New Man., p. 237. 1909.

Lithophragma bulbifera Rydb., N. Am. Fl., vol. 22, pt. 2, p. 86. 1905.

Type locality.—"On the continental divide, at an altitude of 3,000–3,300 meters, at Battle Carbon County, Wyoming."

Range.—Wyoming and Colorado west to the Pacific Coast.

Zone.—Canadian and Hudsonian.

Specimens examined.—Desolation Valley, Tahoe, 8,400 feet, Smiley 92; south side of Mt. Lola, west of Lake Tahoe, damp soil in shade of rocks, Hall and Babcock 4536; Long Lake, Plumas County, 6,800 feet, Hall 9346.

7. SAXIFRAGA

Suffrutescent at base, the stems creeping and forming a mat; leaves narrow, strap-shaped and revolute .... 1. **S. ledifolia**
Herbaceous throughout, plants erect, not mat-forming; leaves flat, not strap-shaped.
  Plants annual; stems branching from the base or near it; the flowers solitary and terminal on the divaricate branches of the cyme; inflorescence bulbiferous .... 2. **S. bryophora**
  Plants biennial or perennial; stems scapose; inflorescence not bulbiferous.
    Leaves orbicular, saliently toothed; stamens clavate.
      Plants large; teeth of the leaves simple .... 3. **S. arguta**
      Plants smaller; teeth of some of the leaves 3-dentate .... 4. **S. Mertensiana**
    Leaves ovate or spatulate, entire or repand-dentate; stamens filiform.
      Flowers in cymules, which are usually aggregated into a head, at least the upper; plants small and delicate.
        Plants not bulbiferous at base; petals narrowed to a claw below; leaves repand .... 5. **S. aprica**
        Plants bulbiferous at base; petals clawless; leaves entire 6. **S. nidifica**
      Flowers in pyramidal panicles, the lower cymules on elongated, somewhat spreading peduncles; plants robust, often of large size .... 7. **S. integrifolia** var. **sierrae**

1. **Saxifraga ledifolia** Greene, Pitt., vol. 2, p. 101. 1891.

Type locality.—"On the higher mountains above Truckee, California.

Range.—Sierra Nevada and northward to Mt. Shasta region, perhaps into southern Oregon.

Zone.—Arctic-alpine and Hudsonian.

Specimens examined.—Sierra County, Lemmon 1020; Tinker's Knob, Placer County, C. F. Sonne, August-September, 1892; Ralston Peak, Tahoe, 8,800 feet, Hall and Chandler 4675; Rubicon Peak, Tahoe, 8,900 feet, Smiley 406; Pyramid Peak, Tahoe, 9,200 feet, Hall and Chandler 4743; same locality, 10,000 feet, Brewer 2142; Mt. Warren Pass, Mono County, Congdon, August 21, 1894; Sawtooth Peak, Tulare County, Culbertson (B 4683); Red Mountain, Sierra Nevada, J. Muir in 1872; rocky slopes near Farewell Gap, Tulare County, 11,500 feet, Purpus 5191; Lower Kaweah Lake, Tulare County, Dudley 1688; Arroyo-Kern divide, Tulare County, Dudley 2421; Fresno County, Eisen.

While our Sierran plant, at least in so far as it has come to my notice, appears to differ from *S. Tolmiei* T. and G. of Washington and northern Oregon in the longer and narrower leaves with the stems firmer and more lignescent, nevertheless certain collections made in Oregon certainly go far to break down the distinctions between these species (cf. *Cusick* 2985 from Crater Lake and *T. Howell* 320 from Mt. Hood).

2. **Saxifraga bryophora** Gray, Proc. Am. Acad., vol. 6, p. 573. 1865.

S. leucanthemifolia var. *integrifolia* Engler, Monogr., Sax., p. 135. 1872.
Spatularia bryophora (Gray) *Small*, N. Am. Fl., vol. 22, p. 148. 1905.

Type locality.—"Ebbett's Pass, and on a peak near Mt. Dana, alt. 9,000 feet on wet rocks."

Range.—Sierra Nevada, northward to Mt. Shasta (see Eastwood, Zoe, vol. 4, p. 136).

Zone.—Hudsonian and Canadian.

Specimens examined.—Half-Moon Lake, Tahoe, McGregor 73; Desolation Valley, Tahoe, 8,600 feet, Smiley 345; ridge south of Donner Pass, 7,500 feet, Heller 7143; head of Fordyce Creek, Placer County, 6,900 feet, Hall 8727; Glen Alpine, Tahoe, Setchell and Dobie, July 6–21, 1901; near Forni, Eldorado County, 8,000 feet, Hall and Chandler 4714; Ebbett's Pass, 9,000 feet, Brewer 1984; Mt. Dana, Bolander 5043; peak near Mt. Dana, 9,000 feet, Brewer 1807; Dana Fork meadows, Yosemite, 9,700 feet, Smiley 849; Tuolumne meadows, in rocky soil near the Lodge, 8,500 feet, Smiley 745; Shuteye Mountain, Madera County, 7,800 feet, J. Murdoch Jr., 2510; meadows near Black Mountain, Fresno County, 9,500 feet, Hall and Chandler 595; trail from Round meadow to Kaiser Crest, Fresno County, 8,500 feet, Smiley 615; King's River, Eisen in 1876; near Mineral King, above timber line near the White Chief Mine, Coville and Funston 1562.

3. **Saxifraga arguta** D. Don, Trans. Linn. Soc., vol. 13, p. 356. 1822.

S. punctata Am. authors, not of L.
S. denudata Nutt., *in* T. and G., Fl., vol. 1, p. 567. 1840.
S. odontophylla Piper, Contr. Nat. Herb., vol. 11, p. 314. 1906.
S. odontoloma Piper, Smithson, Misc. Coll., vol. 50, p. 200. 1907.
Micranthes arguta Small, N. Am. Fl., vol. 22, p. 147. 1905.

Type locality.—"Habitat ad oras occidentales Americae septentrionalis."

Range.—Alaska (southeastern) to California and in the Rockies to New Mexico.

Zone.—Canadian.

Specimens examined.—Cañon above Coldstream, Placer County, C. F. Sonne, August 14, 1897; same locality, Heller 7005; high mountain near Donner Pass, Torrey 157; Slide Mountain, Washoe County, Nevada, 7,500 feet, Heller 10207; head of Fall Creek, Ormsby County, Nevada, Baker 1434; mountains of Fresno County, Eisen; Pitman Creek, Fresno County, 7,200 feet, Smiley 574; Round Meadow, Tulare County, Dudley 1059; along brooks below Farewell Gap, Tulare County, 10,300 feet, Purpus 5232; Rock Creek meadows, eastern Tulare County, 9,700 feet, H. M. and G. R. Hall 8419; Coyote meadows, Tulare County, Culbertson (B 4311).

If *S. odontoloma* is to be accepted as a valid species, other characters must be found than those already indicated. Rosendahl[109] considers our American plant inseparable from the European *S. punctata* L.

4. **Saxifraga Mertensiana** Bong., Mem. Acad. St. Petersb. VI, vol. 2, p. 141. 1832.

Saxifraga heterantha Hook., Fl. Bor. Am., vol. 1, p. 252. 1832.
Steiranisia heterantha Raf., Fl. Tell., vol. 2, p. 69. 1836.
Heterisia mertensiana Small, N. Am. Fl., vol. 22, p. 156. 1905.

Type locality.—"Sitcha."

Range.—Aleutian Islands to California; Selkirks of British Columbia; northern Idaho.

Zone.—Canadian.

Specimens examined.—Emigrant Gap, Placer County, M. E. Jones 57; Castle Peak trail from Soda Springs, 7,300 feet, Smiley 463; Mt. Surprise, Mariposa County, Congdon, August 11, 1890.

5. **Saxifraga aprica** Greene, Bull. Torr. Bot. Club, vol. 23, p. 25. 1896.

S. umbellulata Greene, Erythea, vol. 1, p. 222. 1893, not of Hook., f. and Thoms. 1857.

Type locality.—"On high and dry gravelly spots at 7,000 to 8,000 feet altitude in the Sierra Nevada of California, from near Donner Lake, southward at least to Mt. Dana."

Range.—Mountains of California and southern Oregon.

Zone.—Canadian and Hudsonian.

Specimens examined.—Bierstadt Peak, Tahoe, 7,400 feet, Davy 3207; south side of Mt. Lola, Tahoe, cool cañons, 8,000 feet, Hall and Babcock 4538; near Lake Tenaya, Yosemite, 8,300 feet, Hall and Babcock, 3509; Tuolumne meadows, Yosemite, 8,500 feet, Smiley 828; Mt. Goddard, 11,500 feet, Hall and Chandler 706; Mt. Dana, McLean, July, 1875; near Mineral King, near a mountain lakelet at 3,100 m., Coville and Funston 1519.

6. **Saxifraga nidifica** Greene, Erythea, vol. 1, p. 222. 1893.

Type locality.—"In wet places at about the same elevations as the preceding,* in the California Sierra."

Range.—Sierra Nevada and mountains of northern California.

Zone.—Canadian, occasionally above in the Hudsonian.

Specimens examined.—Cisco, Bolander 1683; Long Lake, Plumas County, 6,700 feet, Hall 9332; Tuolumne meadows, Yosemite, 8,600 feet, R. A. Ware 2667c, 2634c; Tamarack trail, Tahoe, 8,300 feet, Smiley 266; Hockett's meadows, Tulare County, Dudley 1892; Lake Tenaya, Yosemite, 8327 feet, Brewer 1683.

6. **Saxifraga integrifolia** var. **sierrae** Coville, Proc. Biol. Soc. Wash., vol. 7, p. 78. 1892.

Type locality.—"Eight miles northwest of Whitney meadows, on the headwaters of Kern River."

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* The species here referred to is our No. 5.

Range.—Mountains of California and southern Oregon east to the Rockies of Colorado and Wyoming.

Zone.—Transition to Hudsonian.

Specimens examined.—About Marlette Lake, east of Lake Tahoe, 2,460 m., Baker 1395; base of Cloud's Rest, Yosemite, Congdon, August 5, 1898; Pine Ridge, Fresno County, 5,300 feet, Hall and Chandler 156; meadows along Volcano Creek, Tulare County, 8,000 feet, Hall and Babcock 3315; Guyot Creek, Tulare County, 10,500 feet, H. M. and G. R. Hall 8431; Chagoopa Creek meadows, Tulare County, 10,000 feet, Dudley 2240, 2241.

S. oregana Howell (Erythea, vol. 3, p. 34. 1895) is unknown to me from collections; by character it would appear impossible of separation from this variety.

Micranthes montana Small (N. Am. Fl., vol. 22, p. 138. 1905), described from a collection made by Mrs. F. M. Meigs on "Pyramid Peak, California," west of Lake Tahoe, is said to differ from var. *sierrae* by petals more acute and follicles shorter.

JAMESIA

1. **Jamesia americana** T. and G., Fl., vol. 1, p. 593. 1840.

> *Edwinia americana* Heller, Bull. Torr. Bot. Club, vol. 24, p. 477. 1897.
> *Edwinia californica* Small, N. Am. Fl., vol. 22, p. 176. 1905.

Type locality.—"Along the Platte or the Canadian River, near the Rocky Mountains."

Range.—Wyoming to New Mexico and west through the southern part of the Great Basin to the southern Sierra Nevada.

Zone.—Arid Transition to above timber line in the alpine region.

Specimens examined.—White Chief Mine, Mineral King region, 2,900 m., Hall 5649; Mineral King, Brandegee, July 29, 1892; Whitney Creek, Tulare County, 8,500 feet, Culbertson (B 4345); trail to Mt. Whitney, 10,000 feet, Culbertson (B 4576); Old Mt. Whitney, 9–12,000 feet, Purpus 1481.

I have not had an opportunity to examine the type of *E. californica,* which was collected by Miss Eastwood at Volcano Creek Falls, Tulare County, on the border of the Transition and Canadian zones; the other collections from the southern Sierra present no characters unlike those of the southern Rockies.

9. RIBES

Shrubs without spines.
  Berry bright red; leaves obscurely lobed, ½–1.5 inches broad; shrub of the high mountains .... 1. **R. cereum**
  Berry black; leaves distinctly lobed, 1.25–3 inches broad; shrubs of the Canadian and Transition zones.
    Flowers less than ½ inch long; leaves sparingly pubescent or glabrous; racemes dense .... 2. **R. nevadense**
    Flowers over ½ inch long; leaves glandular-pubescent; racemes loose .... 3. **R. viscosissimum**
Shrubs with spines.
  Bark gray, closely adhering to the branchlets, not papery.
    Flowers dark red; berry strongly spinescent .... 4. **R. Roezli**
    Flowers yellow; berry smooth .... 5. **R. lasianthum**
  Bark loosely adherent to the branchlets, yellowish or straw-colored, papery in texture.
    Berry red, glandular-bristly .... 6. **R. montigenum**
    Berry purplish dark red, smooth .... 7. **R. hirtellum** var. **inerme**

1. **Ribes cereum** Dougl., Bot. Reg., sub. pl. 1263. 1829. Trans. Hort. Soc. Lond., vol. 7, p. 512. 1830.

R. inebrians Lindl., Bot. Reg., pl. 1471. 1832.
R. Churchii Nels. and Kennedy, Proc. Biol. Soc. Wash., vol. 19, p. 37. 1906

Type locality.—"On dry exposed decayed granite rocks or schist, throughout the chain of the river Columbia from the great falls 45 degrees, 46 minutes, 17 seconds, N. lat. to the sources of that stream, in the Rocky Mountains, 52 degrees, .07 minutes, .09 seconds."

Range.—Widely distributed in the western part of North America from British Columbia to South Dakota, southward to California and New Mexico.

Zone.—In the Sierran region, this shrub is confined to the high mountains in the Canadian and Hudsonian zones, or locally rising into the alpine region. This zonal position corresponds to Abrams'[92] report for southern California in the main; he places it in the Canadian; but it is in sharp contrast with what Piper[72] decides as to its proper zone in the northwest: in Washington, its zonal position is given as "Arid Transition and Upper Sonoran." Wooton and Standley[110] assign *Ribes inebrians* (a form, in my opinion, incapable of specific definition) to "Woods and cañons, in the Transition Zone" and further say "The common currant in our mountains at middle elevations."

Specimens examined.—Mt. Rose, 10,800 feet, Kennedy 1160; Silver Lake, Amador County, 7,200 feet, E. Mulliken 151; Howard Creek, Sierra County, 7,000 feet, Hall and Babcock 4516; Mt. Rose, in granite at 9,000 feet, Heller 10938; Marlette Lake, east of Lake Tahoe, 8,100 feet, Hall and Chandler 4592; base of Cathedral Peak, above Tuolumne meadows, 9,100 feet, Smiley 819; Kaiser Crest, Fresno County, forming dense thickets at 9,500 feet, Smiley 633; slopes near Farewell Gap, Tulare County, 10–11,000 feet, Purpus 1830; Salmon Creek, Tulare County, 7,500 feet, Hall and Babcock 5143; Lower Bear-paw meadow, Kaweah River region, R. Hopping 51; Olancha Mountain, above timber-line, 11–12,000 feet, Hall and Babcock 5227; head of Tuolumne River, 9,000 feet, Brewer 1769; summit of Sonora Pass, Brewer 1906; along west trail, Mt. Whitney, 12,300 feet, Hall and Babcock 5539; slope of Mt. Kaweah, high as any shrub grows, above 14,000 feet, short thick branches, leaves ½ cm. across, very glandular, Dudley 2102; Mt. Whitney, Culbertson (B 4525).

At the highest elevations of its growth, near or even above timber-line, the branchlets become extremely short and rigid and here the bushes grow close together in dense chaparral; it is this form that has been described as *R. Churchii;* see Coville's note on the appearance of this shrub near timber line in the Mineral King country.[50] Merriam[53] says that on Mt. Shasta it grows at the head of Panther Creek near timber line and also much lower down.

2. **Ribes nevadense** Kellogg, Proc. Calif. Acad., vol. 1, p. 63. 1855.

R. sanguineum var. *variegatum* Wats., Bot. King's Exped., p. 100. 1871.
R. variegatum A. Nels., Key Rocky Mt. Reg., p. 34. 1902.
R. ascendens Eastw., Proc. Calif. Acad. III, Bot., vol. 2, p. 244. 1902.
R. Hittellianum Eastw., *l.c.*, p. 245.
R. glaucescens Eastw., *l.c.*, p. 245.
R. Grantii Heller, Muhl., vol. 4, p. 27. 1908.

Type locality.—Not given.

Range.—Southern Cascades of Oregon through the Sierra Nevada to the mountains of southern California.

Zone.—Transition mainly, but not infrequently rising into the Canadian.

Specimens examined.—(Citation confined to stations within the boreal region): Suzy Lake trail, Eldorado County, 7,600 feet, McGregor 120; Suzy Lake, Tahoe, 7,300 feet, Smiley 196; between Lakes Tahoe and Lucile, 7–8,000 feet, Miss K. A. Chandler, September, 1901; Angora Lake, Tahoe, M. S. Baker, July 5, 1904; Tioga Road near Dark Hole, Yosemite, 7,700 feet, Smiley 878.

3. **Ribes viscosissimum** Pursh., Fl. Am. Sept., p. 163, 1814.

Type locality.—"On the Rocky Mountains in the interior of North America."

Range.—British Columbia to the southern Sierra Nevada and in the Rocky Mountains to Colorado.

Zone.—Transition and Canadian.

Specimens examined.—Slide Mountain, Washoe County, Nevada, 7,500 feet, Heller 10936; near summit of Mt. Tallac, 9,500 feet, Abrams 4830; Grass Lake, Tahoe, McGregor 96; Velma Lakes, Eldorado County, Hudsonian zone, 8,000 feet, Hall 8805; Peregoy's, above Yosemite, A. Gray in 1872; Bridal Veil Creek, Yosemite, 8,000 feet, Bolander 6323; ridge below Nellie Lake, Fresno County, 8,200 feet, Smiley 594; Hockett's meadows, Tulare County, Culbertson (B 4383); Kaweah meadows, Tulare County, rocky places at 9–10,000 feet, Purpus 1767.

3a. **Ribes viscosissimum** Pursh. var. **Hallii** Jancz., Mem. Soc. Genève, vol. 35, p. 328. 1907.

Type locality.—"Pres du lac Independence," Sierra County.

Range.—Same as the species.

Specimens examined.—Near Lake Independence, 7,800 feet, Hall and Babcock 4533; Lake of the Woods, Tahoe, 8,000 feet, Smiley 71; summit of Spanish Peak, Plumas County, 7,000 feet, Hall 9287; Summit, 7,300 feet, Smiley 448; Rubicon Peak, Tahoe, 8,200 feet, Smiley 409.

This variety seems scarcely worth maintaining, its characters of glandless ovary and sepals purple tinted as contrasted with the glandular ovary and sepals greenish white of the species are inconstant; Dr. Hall[101] has called attention to a collection from the Yosemite showing specific and varietal characters upon the same branch; another number indicating the purely arbitrary nature of this separation is *Baker* 1055 from King's Cañon, Ormsby County, Nevada; cited by Janczewski as representing var. *Hallii* with ovary glabrous, the sheet of this number in the Gray Herbarium shows the glandular ovary said to be distinctive of the species.

4. **Ribes Roezli** Regel., Gartenflora, vol. 28, p. 226. 1879.

R. amictum Greene, Pitt., vol. 1, p. 69. 1887.
R. aridum Greene, Pitt., vol. 4, p. 35. 1889.
R. Wilsonianum Greene, Erythea, vol. 3, p. 70. 1895.

Type locality.—Not definitely given.

Range.—Sierra Nevada and mountains of southern California. Mt. Shasta, acc. Merriam.

Zone.—Transition mainly, but occurring abundantly in the *Pinus Jeffreyi* division of the Canadian.

Specimens examined.—Glen Alpine, Tahoe, W. W. Price, July 12, 1898; near Shuteye Pass, 6,500 feet, Sierra National Forest, Abrams 4936; trail to Cloud's Rest above Nevada Falls, 7,600 feet, Smiley 500; Pitman Creek, Fresno County, 7,000 feet, Smiley 580; Sequoia Mills, Fresno County, Eastwood, May, 1894; Bonita meadow, Tulare County, 8,000 feet, Hall and Babcock 5178.

5. **Ribes lasianthum** Greene, Pitt., vol. 3, p. 22. 1896.

Grossularia lasiantha (Greene) Coville and Britton, N. Am. Fl., vol. 22, p. 219. 1908.

Type locality.—"Above Donner Lake toward Castle Peak."

Range.—Sierra Nevada.

Zone.—Hudsonian and uppermost Canadian.

Specimens examined.—Castle Peak near the highest point, Heller 7088; Pyramid Peak, Eldorado County, W. S. Atkinson in 1900; trail from Soda Springs to Castle Peak, 8,600 feet, Smiley 468; Mt. Tallac, Tahoe, talus slope on the east side at 9,500 feet, Smiley 248; Mt. Raymond, Madera County, 8–9,000 feet, Bolander 4885; rocky slopes at head of Little Kern River, Tulare County, 9–9,400 feet, Purpus 1787.

Reported to grow at Merced Lake above Yosemite Valley, a Canadian station.[101]

6. **Ribes montigenum** McClatchie, Erythea, vol. 5, p. 38. 1897.

R. lacustre var. *molle* Gray, Bot. Calif., vol. 1, p. 206. 1876.
R. nubigenum McClatchie, Erythea, vol. 2, p. 80. 1894, not of Philippi, 1857.
R. lacustre var. *lentum* Jones, Proc. Cal. Acad. II, vol. 5, p. 681. 1895.
R. molle Howell, Fl. N.W. Am., vol. 1, p. 209. 1898, not of Poepp., 1858.
R. lentum (Jones) Coville and Rose, Proc. Biol. Soc. Wash., vol. 15, p. 26. 1902.

Type locality.—"On summit of Mt. San Antonio, 10,000 ft. altitude, among dry exposed rocks."

Range.—British Columbia to Montana and in the higher mountains to the south to New Mexico and southern California.

Zone.—Canadian and Hudsonian.

Specimens examined.—Mt. Rose, 9,000 feet, Kennedy 1269; Slide Mountain, Washoe County, 8,600 feet, Heller 10957; Snow Valley, Ormsby County, 2,460–2,615 m., Baker 1150; Summit, 7,000 feet, Bolander, Kellogg and Co.; same locality, Heller 7008; ridge below Lake Lucile, Tahoe, Dudley, June 26, 1900; between Suzy and Heather Lakes, Tahoe, 7,800 feet, Smiley 160; Half-Moon Lake, Tahoe, 7,760 feet, McGregor 55; Mt. Tallac, Tahoe, talus rock, 9,500 feet, Smiley 249, 250; same locality, 8,500 feet, Abrams 4821; summit of Mono Pass, 8,300 feet, Brewer 1722; Carson Spur, Alpine County, 8,500 feet, Hansen 792; Lake Tenaya, 8,000 feet, Brewer 1686; east slope Unicorn Peak, Yosemite, 10,100 feet, Smiley 809; Mt. Lyell, 10,500–11,000 feet, Hall and Babcock 3564; Mt. Goddard, 11,100 feet, Hall and Chandler 680; pine forest between Lake Tenaya and Tuolumne meadows, 9,600 feet, R. A. Ware 2679c; Hockett's meadows, Tulare County, Dudley, June 4, 1902; slope of Mt. Silliman, 10–11,000 feet, Dudley 1486; Olancha Mountain, Tulare County, 10,000 feet, in forest of *Pinus Balfouriana,* Hall and Babcock 5260.

7. **Ribes hirtellum** var. **inerme** (Rydb.) comb. nov.

R. inerme Rydb., Mem. N. Y. Bot. Gard., vol. 1, p. 202. 1900.

Type locality.—"Slough Creek," Montana.

Range.—British Columbia to Montana and south to California (northern Sierra Nevada), Utah, and New Mexico.

Zone.—Transition and Canadian (Lower).

Specimens examined.—Sierra County, Lemmon 803½; Deer Park, Tahoe, Miss H. D. Geiss 50; Plumas County, Mrs. Austin, June 1878; about Marlette Lake, east of Lake Tahoe, 2,460 m., Baker 1301; Upper Tuolumne River, 9,000 feet, Brewer 1756; Mineral King, 7,200 feet, Culbertson (B 4559).

This plant is the western representative of that group of northern gooseberries centering about *R. oxyacanthoides* (L.) Mill of the Hudson Bay region; this has as its best defined species in northeastern North America *R. hirtellum* Michx., one form of which (*R. saxosum* Hook.) is scarcely separable from our western plant; see Fernald.[111]

Ribes lacustre (Pers.) Poir, a species ranging through subarctic North America and extending southward in the west as a subalpine species in the Rocky Mountains to Colorado and Utah, in the Cascades to the mountains of Siskiyou County, is not known from the Sierra Nevada.

30. ROSACEAE (Rose Family)

- Leaves simple.
  - Pistils numerous; leaves deeply palmately lobed .... 1. **Rubus**
  - Pistils solitary; leaves small and merely dentate or entire.
    - Apetalous; pistils persistent and plumose .... 2. **Cercocarpus**
    - Petals present.
      - Ovary superior; fruit a drupe .... 3. **Prunus**
      - Ovary inferior; fruit a pome .... 4. **Amelanchier**
  - Pistils 5.
    - Fruit an achene; flowers white .... 5. **Holodiscus**
    - Fruit a several-seeded follicle; flowers reddish .... 6. **Spiraea**
- Leaves compound.
  - Tall shrubs .... 7. **Pyrus**
  - Herbs or low shrubs.
    - Fruit dry.
      - Pistils 3–many; anthers opening by longitudinal slits.
        - Stamens many (20 or more), borne on the base of the calyx close to the receptacle.
          - Style straight, naked and deciduous .... 8. **Potentilla**
          - Style hooked or plumose and persistent .... 9. **Geum**
        - Stamens 10–20, borne near the throat of the calyx and distant from the receptacle.
          - Filaments broad and petaloid .... 10. **Horkelia**
          - Filaments filiform .... 11. **Ivesia**
        - Stamens 5; leaves trifoliate; flowers yellow .... 12. **Sibbaldia**
      - Pistil solitary; anthers opening by terminal pores .... 13. **Stellariopsis**
    - Fruit fleshy; leaves trifoliate; flowers white .... 14. **Fragaria**

1. RUBUS

1. **Rubus parviflorus** Nutt. Gen., vol. 1, p. 308. 1818.

R. nutkanus Moc., *in* DC., Prodr., vol. 2, p. 566. 1825.

Rubacer parviflorum (Nutt.) Rydb., Bull. Torr. Bot. Club, vol. 30, p. 274. 1903.

Type locality.—"On the island Michilimackinak, Lake Huron."

Range.—Widely distributed in western North America from southeastern Alaska to the Great Lakes, southward to Mexico.

Zone.—Transition and lower Canadian.

Specimens examined.—Glen Alpine, Eldorado County, 7,000 feet, W. W. Price, July, 1898; Grass Lake, Tahoe, McGregor 4; ravine near Fallen Leaf Lake, Tahoe, 7,000 feet, Smiley 361.

This shrub is here included because, though mainly Transition in its zonal position, it is so abundant in certain places in the *Pinus* Jeffreyi division of the Canadian life-zone.

2. CERCOCARPUS

1. **Cercocarpus ledifolius** Nutt., *in* T. and G., Fl., vol. 1, p. 427. 1840.

Type locality.—"Rocky Mountains, in alpine situations on the summits of the hills of Bear River of Timpanagos."

Range.—Pacific Coast east to Montana and Colorado.

Zone.—Arid Transition, mainly near the upper limit of that zone, and extending into the lower Canadian on rocky outcrops.

Specimens examined.—Growing on a rocky point above Grass Lake, Tahoe, Miss Lathrop, July 19, 1909; Silver Mountain, Alpine County, Brewer 2039; mountain near Sonora Pass, 8–9,000 feet, trees 6–10 inches diameter, 15–20 feet high, Brewer 1876; Olancha Mountain, Tulare County, 9,400 feet, Rothrock 330.

2a. **Cercocarpus ledifolius var. intricatus** (Wats.) Jones, Bot. Gaz., vol. 5, p. 154, 1880.

C. intricatus Wats., Proc. Am. Acad., vol. 10, p. 346. 1875.

No specimen of this high mountain form has been seen from the Sierra; it is here included because not unlikely growing on the higher peaks of the Carson Range, east of Lake Tahoe.

3. PRUNUS

1. **Prunus emarginata** (Dougl.), Walp., Repert. Bot., vol. 2, p. 9. 1843.

Cerasus emarginata Dougl., *in* Hook., Fl. Bor. Am., vol. 1, p. 169. 1830.*

Type locality.—"On the upper part of the Columbia River, especialy about the Kettle Falls."

Range.—British Columbia to northwest Montana and south on the Pacific Coast to the mountains of southern California.

Zone.—Arid Transition and locally rising into the Canadian.

Specimens examined.—Spanish Peak, Plumas County, 3–6 feet high, among summit rocks, 7,000 feet, Hall 9291; same locality, 5–6,000 feet, Mrs. Austin in 1877; above Donner Lake toward Donner Pass, Heller 7164; Donner Lake, Dudley, June, 1900; between Fallen Leaf Lake and Glen Alpine, Tahoe, dry hillside, 7,200 feet, Smiley 220; Grass Lake, 7,200 feet, McGregor 94; north slope of moraine, south of Fallen Leaf Lake, 6,900 feet, Smiley 14; Little Shuteye Pass, Sierra National Forest, 7,000 feet, Abrams 4930; Glacier Point, Yosemite, Congdon, May (without year); Mt. Raymond slope at 6,500–7,000 feet, Dudley, July 13, 1901; Grant Park, Tulare County, "the common prune of 7–9,000 ft." Dudley 1233; Big Arroyo, Tulare County, Culbertson (B 4539).

This cherry occurs abundantly in the upper part of the Transition zone and in the lower Canadian, where it forms a considerable part of the chaparral of this altitude.

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*For a detailed synonymy see Wight, W. P., Native American Species of Prunus. Bull. U. S. Dept. Agr. 179, pp. 1–75. 1915.

4. AMELANCHIER

Plant glabrous throughout; leaf tip retuse or truncate; leaf not cordate at base .... 1. **A. glabra**

Plant somewhat tomentulose, at least the ovary hirsute; leaves round-cordate .... 2. **A. siskiyouensis**

1. **Amelanchier glabra** Greene, Fl. Fran., p. 52. 1891.

Type locality.—"In the Donner Lake region of the Sierra Nevada."

Range.—Sierra Nevada.

Zone.—Border of Transition and Canadian.

Specimens examined.—Near Donner Lake, Torrey 126; above Donner Lake toward Pass, Heller 7176; southern Sierra, nine miles west of Mt. Brewer (said on label to have been collected on the State Survey, but without number).

Dr. Nelson accords this species admission to the flora of Colorado (Coulter-Nelson, New Man., p. 266) for the reason that he regards *A. polycarpa* Greene (Pitt., vol. 4, p. 127. 1900) as a synonym; I have not had an opportunity of examining the basis of *A. polycarpa,* but P. C. Standley, after seeing the material in Dr. Greene's herbarium, considered the Colorado plant unlike that of our region (Standley, Proc. Biol. Soc. Wash., vol. 27, pp. 197–198. 1914).

2. **Amelanchier siskiyouensis** C. K. Schneider, Handb. d. Laubholzk., vol. 1, p. 735. 1906.

Type locality.—"Gebirge in Calif., bis 2,000 m." Type *Hansen* 230.

Range.—Central Sierra Nevada to the mountains of Northern California (see note below).

Zone.—Canadian.

Specimen examined.—Silver Lake, Amador County, 8,500 feet, Hansen 230.

Dr. L. R. Abrams[92] suggests that the range of this species should possibly be extended to include certain collections made in the San Bernardino Mountains of southern California (Dry Lake Cañon, 9,000 feet, *Abrams and McGregor* 785).

Amelanchier alnifolia Nutt. (Jour. Acad. Phila., vol. 7, p. 22. 1834), with which the two species last named have been confused and from which they are separated by characters none too precise, is a common shrub ranging widely in the west and abundant in the Sierra below our borders or just meeting them.

5. HOLODISCUS

Leaves ovate; pubescence, if present, sericeous ....1. **H. dumosus**
Leaves round-ovate; pubescence of spreading, somewhat rigid hairs ....
....2. **H. Boursieri**

1. **Holodiscus dumosus** Heller, Cat. N. Am. Pl., p. 4. 1898.

Spiraea dumosa Nutt., *in* T. and G., Fl., vol. 1, p. 416. 1840, as synonym; Hook., Lond. Journ. Bot., vol. 6, p. 217. 1847.
Spiraea discolor var. *dumosa* Wats., Bot. Calif., vol. 1, p. 170. 1878.
Sericotheca concolor Rydb., N. Am. Fl., vol. 22, p. 264. 1908.
Holodiscus saxicola Heller, Muhl., vol. 1, p. 41. 1904.
Sericotheca obovata Rydb., N. Am. Fl., vol. 22, p. 264. 1908.

Type locality.—East slope of the Rocky Mountains along Platte River.

Range.—Wyoming to Chihuahua and west to the Pacific Coast.

Zone.—Canadian to Hudsonian.

Specimens examined.—Granite rocks at Donner Pass, 7,000 feet, Heller 7160; summit back of Jonesville, Butte County, 7,000 feet, Heller 11667; Silver Lake, Amador County, 7,200 feet, E. Mulliken 148; Mt. Tallac, Tahoe, talus slope on east side, 8,300 feet, Smiley 226; Hunter Creek Cañon, Washoe County, Nevada, 7,500 feet, Heller 10353; Glen Alpine, Tahoe, 7,000 feet, W. W. Price, July 12, 1898; Clear Creek Cañon, Ormsby County, Nevada, 2,000–2,615 m., Baker 1431; Mono Pass, Congdon, August 16, 1894; Cloud's Rest trail, 7,400 feet, Smiley 496; summit of Half-dome, Yosemite, Lemmon, August 19, 1878; trail from Round meadow to Nellie Lake, Fresno County, 8,100 feet, Smiley 592; Coyote Creek, Tulare County, Culbertson (B 4332); Mt. Silliman, Tulare County, 9–10,000 feet, Dudley 1470; White-water Peak, Tulare County, among summit rocks, Dudley 632; mountains near Farewell Gap, 10–11,000 feet, Purpus 5121.

Although as Dr. H. M. Hall has pointed out[79] the vegetative characters of this shrub change with change of environment, the essential specific characters of the flowers remain constant; the same is true of the nature of the pubescence, which is always more or less silky and present in varying amounts.

2. **Holodiscus Boursieri** (Carr.) Rehder., Cycl. Hort., vol. 3, p. 1498. 1915.

Spiraea Boursieri Carr., Rev. Hort., 1859, p. 520. 1859.
Sericotheca Boursieri Rydb., N. Am. Fl., vol. 22, p. 263. 1908.

Type locality.—"California," without locality.

Range.—Sierra Nevada.

Zone.—Canadian and Hudsonian.

Specimens examined.—Silver Valley, 8,000 feet, on dry volcanic rocks, Brewer 1974; peak near Sonora Pass, 11,000 feet, Brewer 1925; Cloud's Rest, 10,000 feet, A. Gray in 1872.

6. SPIRAEA

Erect branching shrub; the red flowers in dense panicles ....1. **S. densiflora**
Low depressed shrub; the white flowers spicate ....2. **S. caespitosa**

1. **Spiraea densiflora** Nutt., *in* T. and G., Fl., vol. 1, p. 414. 1840.

S. betulaefolia Pall. var. *rosea* Gray, Proc. Am. Acad., vol. 8, p. 381. 1872.
S. lucida Dougl. var. *rosea* Greene, Pitt., vol. 2, p. 221. 1892.
S. arbuscula Greene, Erythea, vol. 3, p. 63. 1895.
S. Helleri Rydb., N. Am. Fl., vol. 22, p. 248. 1908.

Type locality.—Blue Mountains of Oregon.

Range.—British Columbia to Montana, south along the mountains of Washington, Oregon, and California to the central Sierra Nevada.

Zone.—Canadian.

Specimens examined.—Near Summit Station, Heller 7022; Sierra County, Lemmon 704; Glen Alpine to Mt. Tallac, Setchell and Dobie, July 6–21, 1901; summit back of Jonesville, Butte County, 7,000 feet, Heller 11665; Gilmore Lake, Tahoe, 8,300 feet, Abrams 4856; Silver Lake, Alpine County, 8,000 feet, Hansen 235; shores of Angora Lake, Tahoe, 7,600 feet, Smiley 34; Grass Lake, Tahoe, McGregor 13; Ebbett's Pass, 8,900 feet, Brewer 2090; soda springs of the Tuolumne, Yosemite, 8,680 feet, Brewer 1777; Lake Tenaya, Yosemite, 8,143 feet, border of lake, Smiley 701; Shuteye Pass, Sierra National Forest, 7,000 feet, Abrams 4937; Shuteye Mountain, Madera County, 8,000 feet, J. Murdoch Jr. 2521.

In the Sierra, this shrub does not seem to rise so high as in the mountains of Washington; in our region it is preëminently a plant found about lake borders of the Canadian; in Washington, Piper assigns it to the Hudsonian, while according to C. S. Sargent (Gard. and Forest, vol. 10, p. 410), it forms dense mats at timber line at 5,000 feet on the Olympics and on Mt. Rainier ascends 2,000 feet higher.

2. **Spiraea caespitosa** Nutt., *in* T. and G., Fl., vol. 1, p. 418. 1840.

Eriogynia caespitosa Wats., Bot. Gaz., vol. 15, p. 242. 1890.
Luetkea caespitosa O. Kuntze, Rev. Gen., vol. 1, p. 217. 1891.
Petrophyton caespitosum (Nutt.) Rydb., Mem. N. Y. Bot. Gard., vol. 1, p. 206. 1900.
Petrophyton acuminatum Rydb., N. Am. Fl., vol. 22, p. 253, 1908.

Type locality.—"On high shelving rocks in the Rocky Mountains, towards the sources of the Platte."

Range.—Montana and Black Hills of South Dakota to New Mexico and west in the mountains of Arizona and southern Nevada to the southern Sierra Nevada.

Zone.—Arid Transition or Canadian.

Specimen examined.—Big Arroyo, Tulare County, Culbertson (B 4540).

The specimen cited is the basis for *P. acuminatum* Rydb.; it would seem that the characters relied upon to distinguish this species have been incautiously chosen: it is said that in the type the petals are "very acute or acuminate," but in the specimen of this collection preserved in the Gray Herbarium the petals are really truncate, or similar to those of Nuttall's species.

7. PYRUS

1. **Pyrus sitchensis** var. **californica** (Greene), comb. nov.

Sorbus californica Greene, Pitt., vol. 4, p. 131. 1900.

Type locality.—"Common at middle elevations in the Californian Sierra."

Range.—Sierra Nevada.

Zone.—Canadian and Hudsonian.

Specimens examined.—Mt. Elwell, Plumas County, 7,800 feet, Hall 9340; Gold Lake, Sierra County, 6,400 feet, Hall and Babcock 4514; Glen Alpine, Tahoe, W. W. Price, July 8, 1898; Fallen Leaf trail to Mt. Tallac, 8,000 feet, Abrams 4814; Silver Lake, Amador County, 8,000 feet, Hansen 789; Summit, Placer County, 7,000 feet, Heller 9835, 7026; Ralston Peak, Tahoe, 8,300 feet, Smiley 416; Ebbett's Pass, 6,500–8,500 feet, Brewer 2091; Shuteye Pass, Sierra National Forest, 7,000 feet, Abrams 4943; base of Pyramid Peak, Tahoe, 8,600 feet, Smiley 76; Chilnualna Falls, Mariposa County, Congdon, August 21, 1889; Dog Lake, near Tuolumne meadows, 9240 feet, Smiley 837; Farewell Gap, Tulare County, 10,000 feet, Culbertson (B 4527); near Alta Peak, Tulare County, 9–10,000 feet, Dudley 988.

I am not certain whether this is even varietally distinct from *P. sitchensis* (Roem.) Piper, a species ranging from southeastern Alaska to at least northwestern California, but our form commonly shows the leaflets smaller with their distal ends abruptly acuminate, as contrasted with the typical form of the northwest coast.

8. POTENTILLA

Petals yellow, rarely white.
  Shrubby perennial; style lateral on the densely villous achene 1. **P. fruticosa**
  Plants not shrubby above the woody caudex.
    Style nearly terminal; ovules pendulous.
      Leaves pinnate.
        Style much longer than the mature achene, filiform.
          Leaflets densely white silky villous, dentate only about the apex; petioles short .... 2. **P. Breweri**
          Leaflets green on both sides and serrate along the edges; petiole long .... 3. **P. dissecta**
        Style not longer than the mature achene, thick and glandular below .... 4. **P. pseudosericea**
      Leaves digitate.
        Leaflets more than 3, leaves not trifoliate.
          Leaflets usually about 7.
            Leaves long-petioled, glabrate above .... 5. **P. etomentosa**
            Leaves short-petioled, densely silky on both sides .... 6. **P. concinnaeformis**
          Leaflets usually 5.
            Plants tall (1 foot or more); leaves nearly glabrous above, densely white-tomentose below .... 7. **P. gracilis**
            Plants low (4–6 inches high); leaves silky on both sides; leaflets cuneate and crenate only about the apex .... 8. **P. Wheeleri**
        Leaves trifoliate.
          All 3 leaflets sessile or nearly so .... 9. **P. flabellifolia**
          Terminal leaflet long stalked .... 10. **P. Grayi**
    Style nearly basal; ovules ascending or nearly erect.
      Flowers yellow .... 11. **P. glandulosa**
      Flowers white .... 12. **P. lactea**
Petals red .... 13. **P. palustris**

1. **Potentilla fruticosa** L., Sp. Pl., p. 495. 1753.

Dasiphora fruticosa (L.) Rydb., Mem. Dept. Bot. Columbia Univ., vol. 2, p. 188. 1898.†

Type locality.—"Habitat in Eboraco, Anglia, Oelandia australi, Sibiria."

Range.—Holarctic realm; in North America south from the arctic regions to New Jersey, Great Lakes, northern Iowa, New Mexico, Arizona, and California.

Zone.—Canadian to Arctic-alpine.

Specimens examined.—Sierra County, Lemmon 735; near summit of Tinker's Knob, Tahoe, Kennedy and Doten 275; Desolation Valley, Tahoe, Setchell and Dobie, July 6–21, 1901; Tamarack trail, Tahoe, 8,200 feet, Smiley 253; Bloody Cañon, Mono County, R. A. Gibbs, August, 1898; Ebbett's Pass, 8–9,000 feet, Brewer 2087; Mt. Gibbs, south side in granite, 10,100 feet, Smiley 764; saddle between Mt. Dana and Mt. Gibbs, Chesnut and Drew, July 17, 1889; Mt. Lyell, Yosemite, 9,300 feet, Hall and Babcock 3558; Mono Pass, Congdon, August 16, 1895.

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† For detailed synonymy see N. Am. Fl., vol. 22, p. 366. 1908.

2. **Potentilla Breweri** Wats., Proc. Am. Acad., vol. 8, p. 555. 1873.

Type locality.—"Mono Pass in the Sierra (1720 *Brewer*); summit above Cisco (*Bolander*)."

Range.—Sierra Nevada, northward to the Warner Mountains of Modoc County.

Zone.—Canadian.

Specimens examined.—Summit above Cisco, Bolander, Kellogg and Co. in 1872; Deer Park, Tahoe, Miss H. D. Geiss 37a, 37c, 37b*; Soda Springs, Nevada County, Jones, 351a, 351, 323; Independence Lake, Nevada County, C. F. Sonne 1; Mt. Rose, 9,650 feet, Heller 9902; Mt. Tallac, Tahoe, 9,000 feet, G. R. Hall 8792; Snow Flat, Yosemite, Hall and Babcock, 3630*; Lundy trail, Mt. Warren, Yosemite, Congdon, August 21, 1894; Mt. Dana, 12,500 feet, Bolander 5084*; Dana Fork meadows, Yosemite, 9,800 feet, Smiley 853; Tuolumne meadows, 8,600 feet, R. A. Ware 2693c; Kaiser Crest, Fresno County, 9,600 feet, Smiley 631*; Hockett's meadows, Dudley 1874; Alpine Zone at Eagle Lake, near Mineral King, 10,500 feet, Hall and Babcock 5363*; Farewell Gap, Tulare County, 10–11,000 feet, Purpus 5675*; Bullion Flat near Mt. Whitney, Dudley 2527; mountains above Whitney meadows, 11–12,000 feet, Purpus 1652.*

3. **Potentilla dissecta** Pursh., Fl. Am. Sept., p. 355. 1814.

Type locality.—"Near Hudson's Bay."

Range.—British Columbia to Saskatchewan to California and Colorado.

Zone.—Canadian?

Specimen examined.—Mono train, Yosemite, 8,600 feet, Brewer 275.

3a. **Potentilla dissecta** Pursh. var. **glaucophylla** (Lehm.) Wats., Proc. Am. Acad., vol. 8, p. 556. 1873.

P. glaucophylla Lehm., Delect. Sem. Hort. Bot. Hamb., 1836, p. 7. 1836.

Type locality.—Not ascertained.

Range.—Widely distributed in western North America from California and Colorado northward.

Specimens examined.—Tuolumne meadows, rich damp soil by Tuolumne River, Yosemite, 8,600 feet, R. A. Ware 2684c; soda springs, Tuolumne meadows, Miss Eastwood, July 5–19, 1902.

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* These collections represent the var. *expansa* Wats. (Bot. Calif., vol. 1, p. 179, 1876), described from a collection made by Lemmon in Sierra County, and differing from the species in the decumbent stems and loosely aggregated flowers; both species and variety grow together (see Miss H. D. Geiss as above; also *Dudley* 1874 shows both forms together upon Hockett's meadows).

4. **Potentilla pseudosericea** Rydb., Mem. N. Y. Bot. Gard., vol. 1, p. 98. 1898.

Type locality.—Not given except as "Nevada," but the collection upon which the description is based is *Shockley* 592 from the White Mountains, 13,000 feet, Inyo County, California.

Range.—Ranges of the Great Basin and in the Sierra Nevada?

Specimen examined.—Olancha Peak, Tulare County, 12,000 feet, Purpus 1865.

5. **Potentilla etomentosa** Rydb., Bull. Torr. Bot. Club., vol. 24, p. 8. 1897.

P. rigida Newberry, Pac. R.R. Rep., vol. 6, p. 72. 1857, not of Nutt.
P. gracilis var. *rigida* Coville, Contr. Nat. Herb., vol. 4, p. 96. 1893.

Type locality.—Not given.

Range.—California and Nevada.

Zone.—Canadian?

Specimens examined.—About Marlette Lake, east of Lake Tahoe, 2,460 m., C. F. Baker 1383; near Mineral King, Coville and Funston 1399; giant forest, Tulare County, Mrs. Brandegee, July, 1905; Suzy Lake, Tahoe, dry ground, 7,800 feet, Smiley 166.

This species is very near *P. pulcherrima* Lehm. and perhaps subspecific to that species.

6. **Potentilla concinnaeformis** Rydb., Mem. Dept. Bot. Columbia Univ., vol. 2, p. 54. 1898.

Type locality.—"Arizona: J. G. Lemmon, no. 3294 (Mt. Agassiz, 10,000 ft.)."

Range.—Arizona and California.

Specimen examined.—Near head of Stanislaus River, Alpine County, 7,800 feet, Hall and Chandler 4778.

7. **Potentilla gracilis** Dougl. var. **rigida** Wats., Proc. Am. Acad., vol. 8, p. 557. 1873.

P. rigida Nutt., Jour. Acad. Phila., vol. 7, pt. 1, p. 20. 1834.

Type locality.—"Towards the sources of the Missouri, and as far down as the old Arikaree village."

Range.—Southern Oregon to southern California.

Zone.—Arid Transition and Canadian.

Specimens examined.—Near Glen Alpine, Miss Lathrop, July 19, 1909; Half-Moon Lake, Tahoe, 7,760 feet, McGregor 80; Donner Lake, Heller 6927, 6889; Hockett's meadows, Culbertson (B 4442); near Mineral King, Tulare County, 7,800 feet, Hall and Babcock 5383.

8. **Potentilla Wheeleri** Wats., Proc. Am. Acad., vol. 11, p. 148. 1876.

Type locality.—"In the southern Sierra Nevada, about the headwaters of Kern River, at 8,200 feet elevation."

Range.—Southern Sierra Nevada and mountains of southern California.

Zone.—Canadian.

Specimens examined.—Whitney meadows, Tulare County, Coville and Funston 1672; Olancha Mountain, 8,500 feet, Hall and Babcock 5284; trail to Mt. Whitney, 8,000 feet, Culbertson (B 4550); southern Sierra, Rothrock 324; Fish Creek, Tulare County, 8,400 feet, Hall and Babcock 5209; Whitney meadows, Purpus 1628.

9. **Potentilla flabellifolia** Hook., *in* T. and G., Fl., vol. 1, p. 442. 1840.

Type locality.—"Summit of Mount Rainier, Oregon, *Douglas*." (According to Piper, the collector was probably Tolmie.)

Range.—Pacific Coast from Alaska to California, east to northern Idaho.

Zone.—Hudsonian and Arctic-alpine, locally coming down into the Canadian.

Specimens examined.—Plumas County, Mrs. Austin; Castle Peak, 8,500 feet, Smiley 487; near Lake Lucile, Tahoe, Setchell and Dobie, July 6–21, 1901; Mt. Rose, 9,650 feet, Heller 9890; Desolation Valley, Tahoe, 8,500 feet, Smiley 345; near Tinker's Knob, Tahoe, wet grassy slopes, C. F. Sonne, August 27, 1893; Mt. Conness, Yosemite, J. M. Hutchings, August, 1892; Crescent Lake, Mariposa County, Congdon, August 10, 1890; near Lake Tenaya, meadow above lake, 8,300 feet, Smiley 698; Snow Flat, Yosemite, 8,700 feet, Hall and Babcock 3491; upper end Dana Fork meadows, Yosemite, 10,000 feet, Smiley 859; Mt. Lyell, 10,500 feet, Hall and Babcock 3571; Cloud's Rest, E. R. Drew, July 25, 1887; Tuolumne meadows, 8,600 feet, R. A. Ware, 2698c; north ravine on Mt. Silliman, Tulare County, 10–11,000 feet, Dudley 1511; Kaweah Peaks, along Black Peak brook, 12,000 feet, Dudley 2118; Eagle Lake, Tulare County, 10,500 feet, Hall and Babcock 5362.

This is the commonest species in the wet meadows of the high mountains and one of the most conspicuous plants by reason of its brilliant yellow flowers.

10. **Potentilla Grayi** Wats., Proc. Am. Acad., vol. 8, p. 560. 1873.

Type locality.—"Yosemite Valley (*Bolander; Gray*); Lake Tenaya (*Brewer*)."

Range.—Central Sierra Nevada.

Zone.—Canadian and Hudsonian.

Specimens examined.—Westfall's meadows, above Yosemite, 8,000 feet, Bolander 4971; Peregoy's, above Yosemite, A. Gray in 1872; Lake Tenaya, 8,327 feet, Brewer 1685; Crescent Lake, Mariposa County, Congdon, August 13, 1895; Elizabeth Lake meadow, above Tuolumne meadows, 9,800 feet, Smiley 796; meadows near Black Mountain, Fresno County, 10,000 feet, Hall and Chandler 615; peaks of the Sierra above Owens Lake, 10,000 feet, A. Kellogg in 1873.

11. **Potentilla glandulosa** Lindl. var. **nevadensis** Wats., Bot. Calif., vol. 1, p. 178. 1876.

Drymocallis glandulosa monticola Rydb., Mem. Dept. Bot. Columbia Univ., vol. 2, p. 199. 1898. N. Am. Fl., vol. 22, p. 370. 1908, as species.

Type locality.—"In the Sierra Nevada from the South Fork of Kern River (*Rothrock*) to Oregon."

Range.—Sierran region extending to the mountains of northern and southern California. Northern Coast Ranges (Lake County).

Zone.—Transition and above.

Specimens examined.—Gold Lake, Sierra County, 6,400 feet, Hall and Babcock 4499; Silver Lake, Amador County, 7,200 feet, E. Mulliken 153; Heather Lake, Tahoe, 8,100 feet, Smiley 287; north side of Angora Peak, Tahoe, 7,600 feet, Smiley 17a; Mt. Tallac, Tahoe, 9,600 feet, Hall and Chandler 4623; same locality, 9,500 feet, Smiley 236; Mt. Goddard, 11,100 feet, Hall and Chandler 682*; Mt. Gibbs, 11,000 feet, Smiley 774*; Tuolumne meadows, Yosemite, foot of Lambert's Dome, 8,500 feet, Smiley 825; Monarch Lake, Tulare County, 11–12,000 feet, Dudley 1610*; Farewell Gap, rocky places, 10–11,000 feet, Purpus 2073*.

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* These forms of the highest mountains constitute *Drymocallis monticola,* an alpine reduced state of the variety incapable of precise definition.

11a. **Potentilla glandulosa** Lindl. f. **Hanseni** Wolfe, Bibl. Bot., vol. 71, p. 136. 1908.

Potentilla Hanseni Greene, Pitt., vol. 3, p. 20. 1896.

Type locality.—No exact locality given.

Range.—Central and southern Sierra Nevada.

Zone.—Canadian mainly.

Specimens examined.—Head of Tuolumne River, 9,000 feet, Brewer 1767; soda springs of the Tuolumne, 8,700 feet, Brewer 1705, 1714; same locality, 8,600 feet, R. A. Ware 2686c, 2637c; Black Peak west of Home Camp meadow, Fresno County, 7,800 feet, Smiley 657; Hockett's meadows, Tulare County, Culbertson (B 4469).

Stems and leaves less glandular than the preceding variety.

12. **Potentilla lactea** Greene, Pitt., vol. 3, p. 20. 1896.

P. glandulosa var. *lactea* Greene, Fl. Fran., p. 65. 1891.

Type locality.—"Higher elevations in Fresno and Kern counties."

Range.—Central and southern Sierra Nevada.

Specimens examined.—Tuolumne meadows, Yosemite, 8,500 feet, dry ground near Parsons Lodge, Smiley 833; Crabtree meadow, Upper Kern River, 10,350 feet, H. M. and G. R. Hall 8448; Sawtooth Peak, Tulare County, 11,000 feet, Hall and Babcock 5686.

13. **Potentilla palustris** (L.) Scop., Fl. Carn., ed. 2, vol. 1, p. 359. 1772.

Comarum palustre L., Sp. Pl., p. 502. 1753.

Type locality.—European.

Range.—Holarctic realm; in America from subarctic regions south to New Jersey, Great Lakes, Iowa, Wyoming, and California.

Zone.—Transition mainly, rising into the Canadian.

Specimens examined.—Sierra County, Lemmon 1034; Lake Tahoe, Lemmon.

Although mainly if not in our region exclusively a transition plant, this species is here included because it without doubt belongs to the glacial flora.

9. GEUM

Flowers yellow; styles jointed, the distal part deciduous ......1. **G. macrophyllum**
Flowers purple; styles not jointed, persistent and plumose ....2. **G. triflorum**

1. **Geum macrophyllum** Willd., Enum., p. 557. 1809.

Type locality.—"Camtschatca."

Range.—Alaska to California and east to the Rocky Mountains; Newfoundland and northern New England.

Zone.—Transition and Canadian.

Specimens examined.—About Marlette Lake, Washoe County, 2,460 m., Baker 1387; King's Cañon, Ormsby County, 1,700–2,000 m., Baker 1284; Twin Lakes, Alpine County, 8,500 feet, Hansen 1312; Sierra County, Lemmon 731; trail to Castle Peak, 7,500 feet, Smiley 470.

2. **Geum triflorum** Pursh., Fl. Am. Sept., vol. 1, p. 736. 1814.

Sieversia triflora (Pursh.) R. Br., *in* Richards., Bot. App. Frankl. Journ., ed. 2, p. 21. 1823.

Type locality.—"Upper Louisiana" (South Dakota).

Range.—Widely distributed in North America: transcontinental at the north; on the Pacific Coast from British Columbia to California and Arizona; along the Rockies to Colorado.

Zone.—Arid Transition and Canadian.

Specimens examined.—Ridge south of Donner Pass, 8,500 feet, Heller 7157; Sierra Nevada, Kellogg, July 12, 1870; Mt. Rose, C. L. Brown, July 25, 1907; on a volcanic cone above Ebbett's pass, 8,500 feet, Brewer in 1863.

The last collection furnished Dr. Greene the basis for *Erythrocoma canescens* (Leaflets, vol. 1, p. 178. 1906), for the acceptance of which, no adequate reasons were advanced at the time of publication or have since been proposed; see C. P. Smith.[112]

10. HORKELIA

Sepals becoming reflexed; stamens about 20 ....1. **H. purpurascens**
Sepals not becoming reflexed; stamens about 10.
  Leaflets 10–16; hypanthium glandular and purplish ....2. **H. fusca**
  Leaflets 4–8; hypanthium silky but scarcely glandular, and green ....3. **H. tridentata**

1. **Horkelia purpurascens** Wats., Proc. Am. Acad., vol. 11, p. 148. 1876.

Potentilla purpurascens Greene, Pitt., vol. 1, p. 105. 1887.
Horkeliella purpurascens Rydb., N. Am. Fl., vol. 22, p. 282. 1908.

Type locality.—"On the headwaters of Kern River, at 9,000 feet altitude."

Range.—Southern Sierra Nevada.

Zone.—Canadian.

Specimens examined.—Southern Sierra, 9,000 feet, Rothrock 327 (type); Hockett's meadows, Tulare County, Dudley 1871; Funston's meadows, Tulare County, 8–9,000 feet, Dudley 2157, only slightly pubescent and hence approaching the following variety.

1a. **Horkelia purpurascens** var. **pinetorum** (Coville), comb. nov.

Potentilla purpurascens pinetorum Coville, Proc. Biol. Soc. Wash., vol. 7, p. 77. 1892.
Horkelia pinetorum Rydb., Bull. Torr. Bot. Club, vol. 25, p. 55. 1898.
Horkeliella pinetorum Rydb., N. Am. Fl., vol. 22, p. 282. 1908.

Type locality.—''Trout Meadow, Sierra Nevada, Tulare County, California.''

Range.—Southern Sierra Nevada.

Zone.—Transition and lower Canadian.

Specimens examined.—Trout meadows, Tulare County, Hall and Babcock 5048; Kern River Flat, Tulare County, Culbertson (B 4309); Monache meadows, Olanche Mountain, 8,000 feet, Hall and Babcock 5219.

The variety differs from the species in lacking pubescence; it is common below and in the *Pinus Jeffreyi* zone, while the species is of higher altitudes—*Pinus Murrayana* forests of Hockett's meadows, etc.

2. **Horkelia fusca** Lindl., Bot. Reg., vol. 23, t. 1997. 1837.

Potentilla Douglasii Greene, Pitt., vol. 1, p. 103. 1887.

Type locality.—''California,'' without definite station; collected by Douglas.

Range.—Pacific Coast from Washington to California.

Zone.—Transition and Canadian.

Specimens examined.—Summit, Bolander in 1873; near Peregoy's above Yosemite, A. Gray in 1872; Westfall's meadows, Yosemite, Bolander 4966.

2a. **Horkelia fusca** var. **tenella** Wats., Bot. Calif., vol. 1, p. 181. 1876.

Horkelia parviflora Nutt., *in* H. and A., Bot. Beech. Voy., p. 338. 1838.
Potentilla Andersoni Greene, Pitt., vol. 1, p. 104. 1887.

Type locality.—''In Sierra County.''

Range.—Southern Washington to central Sierra Nevada.

Zone.—Canadian and Transition, occasionally at high altitudes.

Specimens examined.—Silver Lake, Amador County, 8,000 feet, Hansen 292; same locality, 7,200 feet, E. Mulliken 127; Lake Tenaya, 8,200 feet, Hall and Babcock 3526; Elizabeth Lake, Tuolumne meadows. 9,800 feet, Smiley 795; meadows near Black Mountain, Fresno County, 9,500 feet, Hall and Chandler 593; about Marlette Lake, east of Lake Tahoe, 2,460 m., Baker 1413.

The variety is the smaller form of the higher mountains, with the small leaves deeply incised.

3. **Horkelia tridentata** Torr., Pac. R.R. Rep., vol. 4, p. 84. 1857.

Ivesia tridentata Gray, Proc. Am. Acad., vol. 7, p. 338. 1868.
Horkelia Tilingi Regel, Acta Hort. Petrop., vol. 1, p. 143. 1871.
Potentilla Tilingi Greene, Pitt., vol. 1, p. 105. 1887.

Type locality.—"Duffield's Ranch," Sierra Nevada.

Range.—Sierra Nevada to southern Oregon.

Zone.—Transition and occasionally in the Canadian.

Specimens examined.—Donner Lake, Heller 6948, 6960; Silver Lake, Amador County, 8,000 feet, Hansen 985.

11. SIBBALDIA

1. **Sibbaldia procumbens** L., Sp. Pl., p. 284. 1753.

Type locality.—"Habitat in alpibus Lapponiae, Helvetiae, Scothiae."

Range.—Holarctic realm; in North America south from the arctic regions to eastern Quebec, White Mountains of New Hampshire; in the Rocky Mountains to northern New Mexico and along the Pacific Coast Mountains to the southern Sierra Nevada.

Zone.—Canadian to Arctic-alpine.

Specimens examined.—High ridge above Donner Pass, 8,500 feet, Heller 7181; Mt. Rose, 10,000 feet, Kennedy 1150; Desolation Valley, Tahoe, McGregor 750; Rubicon Peak, moist flat, 9,000 feet, Smiley 408; Tuolumne meadows, sand margins of Tuolumne River, 8,600 feet, R. A. Ware 2683c; Mt. Dana, 12,500 feet, Bolander 5082; Mt. Goddard, 11,500 feet, Hall and Chandler 598; Cathedral Peak, above Tuolumne meadows, 10,000 feet, Smiley 816; Mt. Lyell, 10,000 feet, Hall and Babcock 3589; Hockett's meadows, Tulare County, Dudley 1,000; Black Peak Brook, Kaweah Peaks, Tulare County, 12,000 feet, Dudley 2117; north ravine of Mt. Silliman, Tulare County, 10–11,000 feet, Dudely 1506; lower slope of Sawtooth Peak, Tulare County, 11–12,000 feet, Dudley 1609; Farewell Gap, 10,300 feet, Purpus 5194.

12. IVESIA

- Flowers white; stamens 10–15 .... 1. **I. unguiculata**
- Flowers yellow.
  - Stamens 15–20 .... 2. **I. campestris**
  - Stamens 5 (in *I. pygmaea* 5–10).
    - Foliage green.
      - Leaflets usually unarmed.
        - Flowers in a corymbiform cyme; stems somewhat viscid .. 3. **I. Gordoni**
        - Flowers in a capitate cyme; stems glabrous .... 4. **I. lycopodioides**
      - Leaflets usually beset with prickles.
        - Plants slightly viscid .... 5. **I. pygmaea**
        - Plants very viscid .... 6. **I. Shockleyi**
    - Foliage densely white-silky, the leaves vermiform .... 7. **I. Muirii**

1. **Ivesia unguiculata** Gray, Proc. Am. Acad., vol. 7, p. 339. 1868.

Potentilla unguiculata Greene, Pitt., vol. 1, p. 105. 1887.
Potentilla ciliata Greene, Pitt., vol. 1, p. 103. 1887.
Horkelia unguiculata Rydb., Mem. Dept. Bot. Columbia Univ., vol. 2, p. 146. 1898.

Type locality.—"Westfall's meadows, Yosemite Valley, lat. 8,000 feet, in wet places, *Bolander.*"

Range.—Sierra Nevada.

Zone.—Canadian.

Specimens examined.—Westfall's meadows, 8,000 feet, Bolander 4964; between Peregoy's and Glacier Point, 7–8,000 feet, A. Gray in 1872; Hockett's meadows, Tulare County, Culbertson (B 4405); Kaweah meadows, Tulare County, 9,300 feet, Purpus 5126a.

Dr. Rydberg considers that the specimens collected by Lemmon in Sierra County and cited by Brewer and Watson in the Bot. Calif., vol. 1, p. 183 to represent a new species which is densely silvery white rather than "somewhat silky, but not silvery-white," the phrase with which he describes the present species (*I. unguiculata* Gray); I have had no opportunity to examine the Lemmon specimens and wish now merely to call attention to *Ivesia sericoleuca* Ryb. (N. Am. Fl., vol. 22, p. 284. 1908), a species said to be restricted to the Sierra Nevada.

2. **Ivesia campestris** (M. E. Jones) Rydb., N. Am. Fl., vol. 22, p. 285. 1908.

Potentilla utahensis var. *campestris* M. E. Jones, Proc. Calif. Acad. II, vol. 5, p. 679. 1895.
Horkelia mollis Eastwood, Bot. Gaz., vol. 41, p. 286. 1906.

Type locality.—Whitney meadows, Tulare County.

Range.—Southern Sierra Nevada.

Zone.—Canadian.

Specimens examined.—Volcano meadows, Tulare County, 8,500 feet, Hall and Babcock 5466; Volcano Creek, 7,500 feet, Hall and Babcock 5448; Hockett's meadows, Culbertson (B 4405); same locality, 2,700 m., Hall 1486.

3. **Ivesia Gordonii** (Hook.) T. and G., Pac. R.R. Rep., vol. 6, p. 72. 1857.

Horkelia Gordonii Hook, Journ. Bot. and Kew Gard. Misc., vol. 5, p. 341. 1853.
Potentilla Gordonii Greene, Pitt., vol. 1, p. 106. 1887.
Ivesia alpicola Howell, Fl. N.W. Am., vol. 1, p. 182. 1898.
Horkelia Gordonii alpicola Rydb., Mem. Dept. Bot. Columbia Univ., vol. 2, p. 152. 1898.

Type locality.—Not precisely given.

Range.—Pacific Coast from Washington to the southern Sierra Nevada east to Montana and Colorado.

Zone.—Hudsonian mainly, rising to and above timber-line.

Specimens examined.—Sierra County, Lemmon 91; summit of Castle Peak, 9,000 feet, Lemmon, September, 1872; Downieville Peak, Sierra County, Lemmon, September 1877; Ebbett's Pass, 9,000 feet, Brewer 2071; Sonora Pass, 10,000 feet, Brewer 1896; soda springs, Tuolumne River, 8,700 feet, Brewer 1698; Lyell Cañon, Yosemite, 9,000 feet, Hall and Babcock 3593; Kaweah meadows, Tulare County, 9,400 feet, Purpus; Whitney meadows, Hall and Babcock 5467 at 8,500 feet; mountains near Farewell Gap, 11–12,000 feet, Purpus 5178*; Cloud's Rest, Chesnut and Drew, July 13, 1889; Brown's meadows, Tulare County, 7,500 feet, Hall and Babcock 5127*; Mt. Dana, common below 12,750 feet, Hall and Babcock 3609*; Sawtooth Peak, 11–12,000 feet, Dudley 1603; Funston's meadows, Tulare County, 8–9,000 feet, Dudley 2158; slope of Mt. Kaweah, rocks above 13,000 feet, Dudley 2101; near Mt. Whitney, Dudley 2476*.

4. **Ivesia lycopodioides** Gray, Proc. Am. Acad., vol. 6, p. 530. 1865.

I. Gordonii var. *lycopodioides* Wats., Bot. Calif., vol. 1, p. 183. 1876.

Type locality.—"High alpine region of the Sierra Nevada, on Mount Dana, alt., 11,000 to 12,000 feet."

Range.—Sierra Nevada.

Zone.—Arctic-alpine.

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* These collections show the petals of large size and this larger size of petal is considered sufficient warrant for *I. megalopetala* Rydb. (N. Am. Fl., vol. 22, p. 289. 1908); in my opinion, the characters are inadequate to maintain the segregate even as a form.

Specimens examined.—Mt. Dana, 11–12,000 feet, Brewer 1746; same locality, 12,000 feet, Smiley 732; same locality, 11,500 feet, R. A. Ware 2621c; Bear Mountain, Mariposa County, Miss Errington.

5. **Ivesia pygmaea** Gray, Proc. Am. Acad., vol. 6, p. 531. 1865.

I. Gordonii var. *pygmaea* Wats., Bot. Calif., vol. 1, p. 183. 1876.

Type locality.—Among rocks in the Sierra Nevada, from 11,000 feet (where it abounds) up to 12,000 feet.''

Range.—Sierra Nevada.

Zone.—Arctic-alpine.

Specimens examined.—Mt. Gibbs, Yosemite, 11,200 feet, Smiley 775; Glacier Lake, Tulare County, Dudley 1698; Cirque Peak, Tulare County, 12,500 feet, Hall and Babcock 5502; Mt. Brewer, 12–13,000 feet, Purpus 1408; same locality, 12,500 feet, E. B. Copeland, August 7, 1899.

There appears to be not a little confusion with regard to the numbers of the collections made in the southern Sierra by C. A. Purpus; his no. 1409 represents a case of this confusion. This number is assigned by Rydberg as the type of *Horkelia chaetophora* Rydb., (Bull. Torr. Bot. Club, vol. 26, p. 543. 1899; *Ivesia chaetophora* Rydb., N. Am. Fl., vol. 22, p. 290. 1908), with locality ''Farewell Gap and Little Kern River,'' Tulare County, and the type is said to be deposited in the herbarium of Mr. T. S. Brandegee; the Brandegee Herbarium is now at the University of California. Search at Berkeley disclosed two collections bearing the no. 1409, one from ''Rocks, Little Kern River, 10–11,000 ft.,'' and the other from ''Kaweah Peak, 11–12,000 ft.''; no collection from Farewell Gap with no. 1409 has been seen. *I. chaetophora* is said to be distinguished, in the generic key to the species in the N. Am. Flora, from *I. pygmaea* by having 10 stamens, 5 stamens being assigned there to *I. pygmaea,* but in the description of *I. pygmaea* on p. 289, the number of stamens is said to be ''5–10.'' It is possible that neither of the specimens seen by me is the type of *L. chaetophora;* certainly the two sheets of *Purpus* 1409 now at Berkeley differ in no perceptible way from typical *I. pygmaea.*

6. **Ivesia Shockleyi** Wats., Proc. Am. Acad., vol. 23, p. 263. 1888.

Type locality.—''Summit of Silver Peak, Alpine County, California.''

Range.—Sierra Nevada and occurring in the White Mountains of Inyo County.

Zone.—Arctic-alpine.

Specimens examined.—Silver Peak, Alpine County, 11,000 feet, Lemmon in 1873; Tinker's Knob, west of Lake Tahoe, high exposed ridges, C. F. Sonne; Mt. Rose, 10,000 feet, Heller 9881.

7. **Ivesia Muirii** Gray, Proc. Am. Acad., vol. 8, p. 627. 1873.

Type locality.—"On Mount Hoffman, at the altitude of 9,500 feet," Yosemite.

Range.—Yosemite region of the Sierra Nevada.

Zone.—Arctic-alpine.

Specimens examined.—Mt. Hoffman, Yosemite, 9,500 feet, J. Muir in 1872 (type); north side of Mt. Conness, Yosemite, J. B. Lembert, August, 1893; Mt. Goddard, 11,500 feet, Hall and Chandler 700.

The last collection conforms to Muir's type in every respect save a larger size; in the type, the petals are as narrow as they could well be, yet in the N. Am. Fl., vol. 22, p. 283, they are said to be "cuneate" and those of *I. Chandleri* Rydb. (*l.c.*, p. 287) "linear."

13. STELLARIOPSIS

1. **Stellariopsis santolinoides** (Gray) Rydb., Mem. Dept. Bot. Columbia Univ., vol. 2, p. 155. 1898.

Ivesia santolinoides Gray, Proc. Am. Acad., vol. 6, p. 531. 1865.
Potentilla santolinoides Greene, Pitt., vol. 1, p. 106. 1887.

Type locality.—"In the Sierra Nevada."

Range.—Sierra Nevada and mountains of southern California.

Zone.—Arid Transition and Canadian.

Specimens examined.—Tahoe, Lemmon in 1873; Lake Valley, Tahoe, 6,400 feet, Abrams 4773; Suzy Lake, Tahoe, 7,650 feet, McGregor 116; Amador County, 8,000 feet, Hansen 717; Cloud's Rest trail, 8,200 feet, Smiley 507; between Peregoy's and Glacier Point, Yosemite, A. Gray in 1872; Merced River at 9,000 feet, Bolander 6007; Tuolumne meadows, sandy places, 8,500 feet, Smiley 738; Shuteye Mountain, Madera County, 6,500 feet, J. Murdoch 2518; Crescent Lake, Mariposa County, Congdon, August 14, 1895; Kettle Mountain ridge, Fresno County, Dudley, August 23, 1904; Sentinel Dome, Yosemite, 8,050 feet, Hall 9141; trail from Round meadow to Nellie Lake, open granite slope, 8,000 feet, Smiley 593; Hockett's meadows, Tulare County, Culbertson (B 4315); Kaweah meadows, 9,300 feet, Purpus 5174; high Sierra about Mt. Brewer, Tulare County, Brewer 2809; Whitney meadows, 2,850 m., Coville and Funston 1623; Mt. Pinos, 8,500 feet, Rothrock 210.

14. FRAGARIA

1. **Fragaria virginiana** var. **platypetala** (Rydb.) Hall, Univ. Calif. Publ. Bot., vol. 4, p. 198. 1912.

F. platypetala Rydb., Mem. Dept. Bot. Columbia Univ., vol. 2, p. 177. 1898.
F. virginiana var. *illinoensis* Wats., Bot. Calif., vol. 1, p. 177. 1876, not Gray.

Type locality.—"Sprout, British Columbia," as given in N. Am. Fl., vol. 22, p. 361.

Range.—Pacific Coast, east to Montana and Wyoming.

Zone.—Transition and Canadian.

Specimens examined.—Base of Angora Peak, Tahoe, 7,200 feet, Smiley 307; near Fallen Leaf Lake, Tahoe, 6,400 feet, Smiley 288; Olancha Mountain, Tulare County, 8,500 feet, Hall and Babcock 5282.

1a. **Fragaria virginiana** var. **platypetala** f. **sibbaldifolia** Hall., Univ. Calif. Publ. Bot., vol. 4, p. 199. 1912.

F. sibbaldifolia Rydb., Mem. Dept. Bot. Columbia Univ., vol. 2, p. 176. 1898.

Type locality.—"California: near Mt. Whitney along branches of Kern River."

Range.—Sierra Nevada; probably co-extensive with that of the above variety.

Zone.—Canadian and Hudsonian.

Specimens examined.—Luther's Pass, Tahoe region, 7,800 feet, Abrams 4758; Tuolumne meadows, Yosemite, Dudley, July 21, 1901; Whitney meadows, Tulare County, Coville and Funston 1712; Chagoopa Creek, Tulare County, meadows at 10,000 feet, Dudley 2239; Whitney Creek, 11,000 feet, Culbertson (B 4348); Nellie Lake meadow, Fresno County, 8,700 feet, Smiley 610.

Purshia tridentata (Pursh) DC. (Trans. Linn. Soc., vol. 12, p. 158. 1817), a common shrub of the Upper Sonoran and Arid Transition from Montana to New Mexico westward to the Pacific Coast, rises in localities on the east flank of the Sierra to our lower limits and occasionally ascends above them (Mt. Tallac, talus slope at 8,300 feet, Smiley 229; Sonora trail, east side of summit, 8,000 feet, Brewer 1861).

31. LEGUMINOSAE (Pulse Family)

Leaves digitate.
  Leaves trifoliate; flowers in heads; anthers uniform ....1. **Trifolium**
  Leaves not trifoliate; flowers in racemes; anthers dimorphic ....2. **Lupinus**
Leaves pinnate.
  Flowers in umbels; pods linear, never inflated ....3. **Hosackia**
  Flowers in racemes; pods broad and usually more or less inflated. 4. **Astragalus**

1. TRIFOLIUM

Heads involucrate; flowers white with dark purple centers ....1. **T. monanthum**
Heads naked; flowers reddish or purple.
  Plants almost glabrous; flowers at length reflexed.
    Rhachis produced as a spur above the head of the nearly sessile, numerous (7–12) flowers ....2. **T. Kingii**
    Rhachis not produced above the few-flowered (3–4) head of pedicelled flowers ....3. **T. Bolanderi**
  Plant pubescent; flowers always erect ....4. **T. longipes**

1. **Trifolium monanthum** Gray, Proc. Am. Acad., vol. 6, p. 523. 1866.

Type locality.—"Moist bank by soda springs, Tuolumne River, alt. 8,700 feet."

Range.—Sierra Nevada.

Zone.—Canadian to Arctic-alpine.

Specimens examined—Slide Mountain, Washoe County, Nevada, 7,600 feet, Heller 10200; Snow Valley, Ormsby County, Nevada, 2,460–2,615 m., Baker 1282; Mt. Rose, 10,000 feet, Kennedy 995; Soda Springs, Nevada County, M. E. Jones 57; Yuba Pass, Sierra County, 6,500 feet, Hall and Babcock 4484; Pyramid Peak, base of east side, 9,300 feet, Smiley 88a; Twin Lakes, Alpine County, 8,500 feet, Hansen 351; Tuolumne meadows, Yosemite, 8,600 feet, R. A. Ware 2654c, 2631c; soda springs of the Tuolumne, 8,700 feet, Brewer 1704; Tuolumne meadows, foot of Lambert's Dome, 8,600 feet, Smiley 757; base of Mt. Dana, Chesnut and Drew, July 16, 1889; Dana-Gibbs divide, above Yosemite, 11,800 feet, Hall and Babcock 3624; meadows near Black Mountain, Fresno County, 10,000 feet, Hall and Chandler 613*; Summit Lake, Tulare County, Culbertson (B 4344); Hockett's meadows, Tulare County, Culbertson (B 4457); Mineral King, 2750 m., Coville and Funston 1473; Independence Lake, Sierra County, 7,000 feet, Hall and Babcock 4543.*

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* These collections represent *T. monanthum* f. *spatiosum* McDermott (Rev. N. Am. Trifolium, p. 98. 1910), differing from the type form in lengthened calyx teeth.

1a. **Trifolium monanthum** var. **parvum** (Kellogg) McDermott, Rev., p. 105. 1910.

T. pauciflorum var. *parvum* Kellogg, Proc. Calif. Acad., vol. 5, p. 54. 1873.
T. multicaule Jones, Bull. Torr. Bot. Club, vol. 9, p. 31. 1882.
T. parvum Heller, Muhl., vol. 1, p. 114. 1905.

Type locality.—"Damp, sandy or springy and somewhat half shady places: Cisco, altitude 6,000 feet, Sierra Nevada Mountains."

Range.—Sierra Nevada.

Zone.—Transition and Canadian.

Specimens examined.—Yuba River at Cisco, Hall 8759; Fallen Leaf Lake, 6,800 feet, Smiley 291; Donner Lake, 6,000 feet, Heller 9831; Silver Lake, Amador County, 8,000 feet, Hansen 979.

Miss Eastwood[89] reports this—*T. multicaule* Jones—from Summit meadow, Tulare County, the most southern locality as yet known.

2. **Trifolium Kingii** Wats., Bot. King's Exped., p. 59. 1871.

T. productum Greene, Erythea, vol. 2, p. 181. 1894.

Type locality.—"Found growing sparingly in a damp cañon above Parley's Park in the Wasatch; 6,500 feet altitude."

Range.—Utah to California.

Zone.—Transition and Canadian.

Specimens examined.—Cisco, Dr. Kellogg, June 29, 1870; Gold Lake, Sierra County, 6,400 feet, Hall and Babcock 4494; Mt. Dyer, Plumas County, Mrs. R. M. Austin in 1880; Summit, Bolander in 1872; same locality, meadow above the station, 7,200 feet, Smiley 446; near Fallen Leaf Lake, 6,400 feet, Smiley 289.

3. **Trifolium Bolanderi** Gray, Proc. Am. Acad., vol. 7, p. 335. 1867.

Type locality—"Westfall's meadows above the Yosemite Valley, at the elevation of 8,000 feet, *Bolander.*"

Range.—Central and southern Sierra.

Zone.—Canadian.

Specimens examined.—Westfall's meadows, 8,000 feet, Bolander 4967; Peregoy's to Inspiration Point, Yosemite, A. Gray in 1872; head of Alder Creek, Yosemite, 7,100 feet, Kennedy and Behrend 3020; North Fork of King's River, 7,000 feet, Hall and Chandler 424.

4. **Trifolium longipes** Nutt. *in* T. and G., Fl., vol. 1, p. 314. 1838.

T. caurinum Piper, Erythea, vol. 6, p. 29. 1898.

Type locality.—"Valleys of the central chain of the Rocky Mountains range, and on the moist plains of the Oregon as low as the Wahlamet."

Range.—British Columbia to Alberta, south to Mexico and Lower California.

Zone.—Transition and Canadian.

Specimens examined.—Webber Valley, Lemmon 1223; north side of Slide Mountain, Washoe County, Nevada, 7,700 feet, Heller 10947; Carson Spur, Alpine County, Hansen 349; Summit, Kellogg, July, 1883; Silver Valley, 7,351 feet, Brewer 1971; Mono Pass, Bolander 6288; Silver Lake, Amador County, 8,000 feet, Hansen 352, 745*; Bonita meadows, Tulare County, 8,500 feet, Hall and Babcock 5187; Golden Trout Creek, Tulare County, 8,900 feet, Hall and Babcock 8416.

2. LUPINUS

- Dwarf caespitose plants.
  - Stems wholly herbaceous.
    - Pubescence dense and shaggy; flowers small .... 1. **L. Lobbii**
    - Pubescence sericeous, the hairs more appressed; flowers larger.
      - The few flowers in short (1.5–2 inches) rather loose spicate racemes. .... 2. **L. Culbertsonii**
      - The many flowers in longer (3–4 inches), densely flowered spicate racemes .... 3. **L. sellulus**
  - Stems woody at base.
    - Leaflets obtuse, 7–10; peduncles short .... 4. **L. Breweri**
    - Leaflets acute, 4–7; peduncles elongated .... 5. **L. danaus**
- Large herbaceous plants with 1 or few stems, not caespitose.
  - Calyx symmetrical or nearly so.
    - Some of the leaflets 2 inches or longer.
      - Foliage deep green, nearly glabrous; racemes long and loose; plant of wet places .... 6. **L. longipes**
      - Foliage grayish with long shaggy hairs; leaflets very narrow, acute, somewhat falcate .... 7. **L. Covillei**
    - All leaflets less than 2 inches long.
      - Leaflets distinctly obtuse and usually broadly lanceolate; pubescence tawny .... 8. **L. obtusilobus**
      - Leaflets acute; pubescence white.
        - Pubescence sparse; petioles longer than the leaflets; keel very strongly falcate and naked .... 9. **L. albicaulis**
        - Pubescence dense, silvery; petioles mostly shorter than the leaflets; keel arcuate but not strongly curved, ciliolate .. 10. **L. meionanthus**
  - Calyx spurred or saccate at base.
    - Spur of calyx produced, the upper lip white at tip; plants densely silvery-silky .... 11. **L. calcaratus**
    - Spur of the uniformly colored calyx short and broad; plants green, the pubescence sparse and appressed .... 12. **L. laxiflorus**

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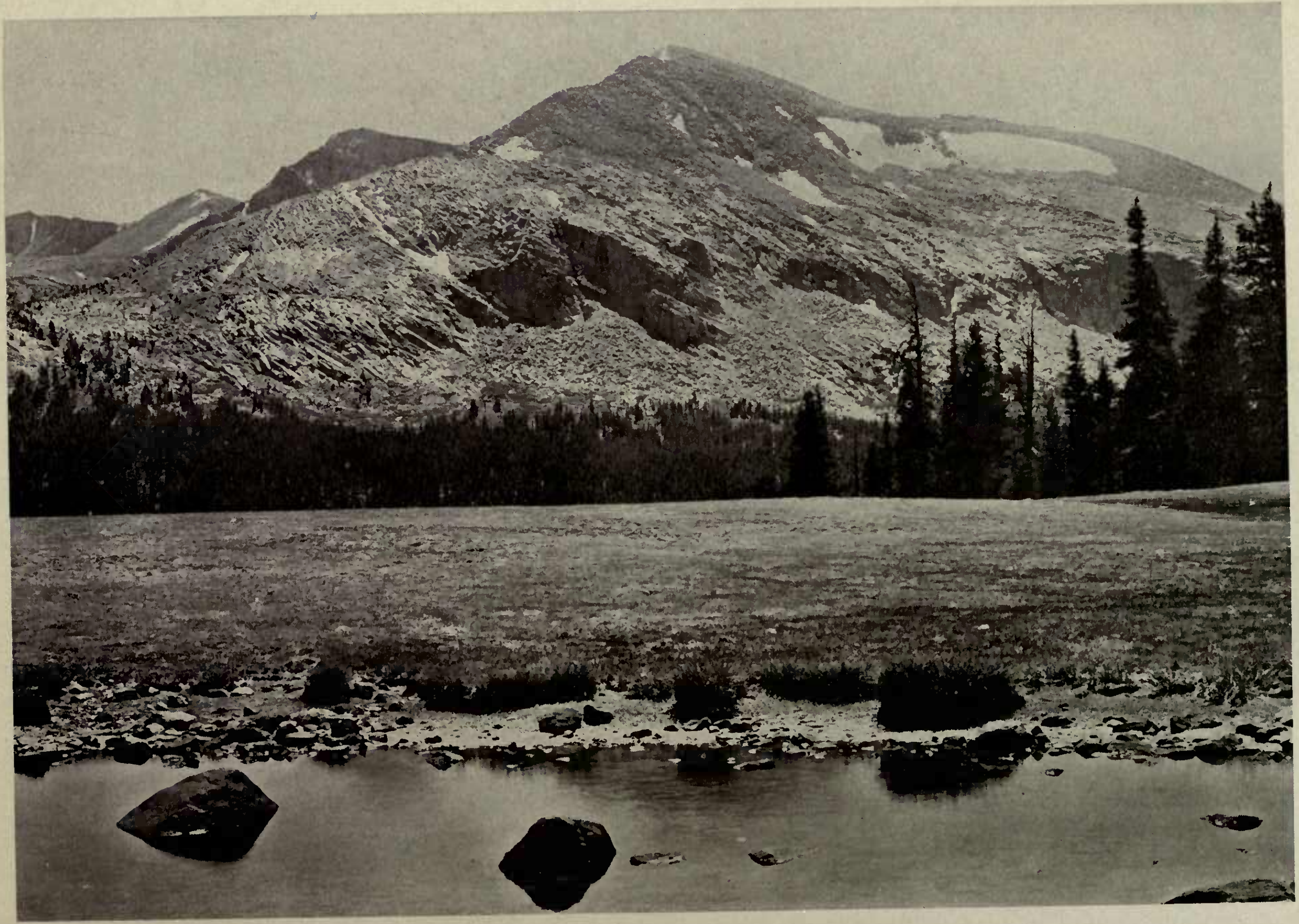
* While the usual color for this species is purplish, there appears to be present in Amador County a local race with livid red flowers, which is represented among the specimens cited by Hansen's collections from Silver Lake; Dr. Greene described this as *T. Hanseni* (Erythea, vol. 3, p. 17. 1895), while Miss McDermott[113] considers it merely a form, f. *Hanseni* McDermott (Rev., p. 250. 1910).



HUDSONIAN MEADOW AND FOREST; ARCTIC-ALPINE ZONE BEYOND; YOSEMITE REGION: MT. GIBBS FROM DANA MEADOWS.

1. **Lupinus Lobbii** Gray, *in* Greene, Fl. Fran., p. 43. 1891.

L. aridus var. *Lobbii* Wats., Proc. Am. Acad., vol. 8, p. 533. 1873.
L. alpinus Heller, Muhl., vol. 6, p. 22. 1910.

Type locality.—"In the high Sierras of California."

Range.—Sierra Nevada.

Zone.—Canadian and Hudsonian, rising locally into the Arctic-alpine.

Specimens examined.—Mt. Rose, 9,650 feet, Heller 9914a; same locality, 9,000 feet, Kennedy 1148; trail to Grass Lake, Tahoe, Miss Lathrop, July 19, 1909; Hermit Valley, Alpine County, Hansen 365; Lake of the Woods, Tahoe, 8,200 feet, Smiley 61; Snow Valley, Ormsby County, Nevada, 2,460–2,615 m., Baker 1374; Gilmore Lake, Mt. Tallac, 8,300 feet, Hall and Chandler 4637; Mt. Stanford, 9,000 feet, C. F. Sonne, August, 1891; Silver Lake, Amador County, 7,200 feet, E. Mulliken 122; above Ebbett's Pass, 8,500 feet, Brewer 2085; Sonora Pass, up to 12,000 feet, Brewer 1894; Tuolumne meadows, 8,600 feet, R. A. Ware 2616c; same locality, 8,500 feet, Smiley 743; mountains of Tuolumne County, 10,000 feet, W. H. Turner, July 19, 1888; Mt. Gibbs, Congdon, August 16, 1894; Mt. Lyell, 11,000 feet, Hall and Babcock 3585; Golden Trout Creek, Tulare County, 8,900 feet, Hall and Babcock 8417.

In *L. alpinus,* I am unable to see anything more than the reduced state of the species consequent upon the increased rigor of life conditions at the elevation where it appears.

2. **Lupinus Culbertsonii** Greene, Leaflets, vol. 1, p. 73. 1904.

L. hypolasius Greene, *l.c.*
L. hypoleucus Greene, *l.c.*

Type locality.—"Forks of the Kaweah River, at 8,000 feet." Tulare County.

Range.—Southern Sierra Nevada northward to about the Yosemite region.

Zone.—Canadian mainly, rising to timber line or above in depauperate forms.

Specimens examined.—South Fork of the Kaweah River, 8,000 feet, Culbertson (B 4475); Kaweah meadows, 9–10,000 feet, Purpus 5125; Summit Lake, Tulare County, Culbertson (B 4552); Farewell Gap, 10,000 feet, Purpus 5221; Mt. Silliman, Tulare County, Mrs. Brandegee, August 23, 1905.

Lupinus crassulus Greene (Muhl., vol. 8, p. 118. 1912), described from a collection made by J. H. Hatton "at an altitude of 10,500 feet in the Stanislaus forest reservation,'' is unknown to me save from description, from which it would appear to be very close to the preceding species, if not indeed identical with it.

3. **Lupinus sellulus** Kellogg, Proc. Calif. Acad., vol. 5, p. 36. 1873.

Type locality.—''At Donner Lake, summit of Sierra Nevada Mountains, California.''

Range.—Sierra Nevada region northward from Mariposa County and probably extending to the mountains of northern California.

Zone.—Canadian.

Specimens examined.—Plumas County, Mrs. Austin in 1876; Summit, Placer County, 6,800 feet, Heller 10588; same locality, E. L. Greene 427; Cisco, Bolander, Kellogg an dCo. in 1872; Lake Tenaya, Yosemite, Congdon, August 19, 1890; same locality, 8,200 feet, Hall and Babcock 3516.

This species is very close to *L. confertus* Kellogg (Proc. Calif. Acad. vol. 2, p. 192) and may be merely its higher mountain form; *L. confertus* is also confined to the Sierran region.

4. **Lupinus Breweri** Gray, Proc. Am. Acad., vol. 7, p. 334. 1867.

Type locality.—''Prostrate, trailing on the ground or on rocks, on the Yosemite trail, alt. 6,000 feet.''

Range.—Oregon to California (Tehachapi Mountains and San Bernardino Mountains?).

Zone.—Arid Transition to above timber line.

Specimens examined.—Gold Lake, Sierra County, Lemmon; Prosser Creek, Nevada County, 5,600 feet, Hall and Babcock 4544; same locality, C. F. Sonne 50; Marlette Lake, east of Lake Tahoe, 2,460 m., Baker 1303; Slide Mountain, Washoe County, Nevada, 8,400 feet, Heller 10964; head of Galena Creek, Washoe County, 8,500 feet, Heller 10223; El Capitan, Yosemite, 7,500 feet, Hall 9196; sandy hillocks back of Sentinel Dome, Yosemite, 7–8,000 feet, A. Gray in 1872; Crescent Lake, Mariposa County, Congdon, August 13, 1895; Snow Flat, Yosemite, on exposed slopes, 8,500 feet, Hall and Babcock 3502; Yosemite trail, 6,000 feet, Brewer 1634; Tioga Road, Yosemite, Congdon, August 28, 1895; Hermit Valley, Alpine County, 8,500 feet, Hansen 365; Mt. Dana, McLean, July 3, 1875; Kaiser Crest, Fresno County, 9,500 feet, Smiley 630; White Chief Peak, Tulare County, Culbertson (B 4401); Soda Creek, Tulare County, 8–8,000 feet, in

Jeffrey Pine belt, Purpus 1794; near Mineral King, V. Bailey (Death Valley 1550, 1654); rocky slopes on Old Mt. Whitney, 12–13,000 feet, Purpus 1676; North Fork of Kern River, 12,000 feet, Rothrock 391; Kaweah meadows, dry woods, 10–11,000 feet, Purpus 5340; Mt. Olancha in *Pinus Balfouriana* belt, 10,500 feet, Hall and Babcock 5247; Mt. Pinos, Rothrock 270.

Although all of the collections above cited do not agree in detail and some of the forms from the highest altitudes present an aspect quite different from the lower mountain and typical form, yet examination failed to disclose characters which would appear to justify taxonomic differentiation.

5. **Lupinus danaus** Gray, Proc. Am. Acad., vol. 7, p. 335. 1867.

L. Lyallii var. *Danaus* Wats., Proc. Am. Acad., vol. 8, p. 534. 1873.

Type locality.—"Mount Dana, alt. about 12,500 feet, *Bolander.*"

Range.—Central Sierra (Mt. Dana) to the Mt. Whitney region.

Zone.—Arctic-alpine.

Specimens examined.—Mt. Dana, 12,000 feet, Congdon, August 11, 1898; same locality, Bolander 5087 (type); foot of Mt. Dana, 10,000 feet, Congdon, August 10, 1898; Mt. Dana, 11,400 feet, Smiley 722; between Mts. Dana and Gibbs, 10,400 feet, Hall and Babcock 3623; Mt. Gibbs to Walker Lake, Congdon, August 16–17, 1894; Silver Mountain, Hooker and Gray in 1877; Mt. Lyell, 9,500 feet, Hall and Babcock 3556; Mt. Whitney, flats near Langley's Camp, Hall and Babcock 5542.

Perhaps the range of this species extends further north than usually believed; Dr. Merriam reports[53] that a plant collected along timber line on Mt. Shasta has been determined by Leiberg as belonging to *L. danaus*, but I suspect that the identification should be with *L. Lyallii* Gray (*l.c.*, p. 334), an arctic-alpine of the Cascades of Washington and Oregon, distinguished by peduncles more hairy and the larger flowers purple, not nearly white as in our species.

6. **Lupinus longipes** Greene, Fl. Fran., p. 41. 1891.

L. procerus Greene, Muhl., vol. 6, p. 10. 1910.

Type locality.—"Along streams at middle or higher elevations in the Sierra, northward to Oregon."

Range.—Southern Oregon southward through the Sierra to the San Bernardino Mountains of southern California.

Zone.—Transition and Canadian, rarely higher.

Specimens examined.—Placer County, Mrs. M. M. Hardy in 1893; lower end Donner Lake, Heller 6911; Fallen Leaf Lodge, 6,900 feet, Abrams 4878; Half-Moon Lake, Tahoe, 7,760 feet, McGregor 74; South Fork of American River near Pyramid Peak, 6,900 feet, Hall and Chandler 4711; Snow Valley, Ormsby County, Nevada, 2,460–2,615 m., Baker 1376; Mt. Rose, 9,650 feet, Heller 9902a; Velma Lakes, Eldorado County, 8,000 feet, Hall 8808; Hope Valley, Alpine County, 8,500 feet, Hansen 1315; near Lake Lucile, Tahoe, Dudley, June 1900; Indian Creek, Yosemite, 7,300 feet, Hall 9174; Monache meadows, Tulare County, 9,500 feet, Rothrock 328; Farewell Gap, Tulare County, 10,000 feet, Culbertson (B 4274); same locality, Dudley 2567.

L. longipes is allied to *L. rivularis* Dougl. of the Coast Range and extending north to Washington, and also to *L. Burkei* Wats. of the Northwest.

7. **Lupinus Covillei** Greene, Proc. Acad. Phila., 1892, p. 365. 1893.

L. dasyphyllus Greene, Leaflets, vol. 1, p. 73. 1904.

Type locality.—"Near Farewell Gap, in the Sierra Nevada of California, at an altitude of 10,000 feet."

Range.—Yosemite region of the Sierra to Tulare County.

Zone.—Canadian and Hudsonian.

Specimens examined.—Mt. Hoffman, Yosemite, 8,500 feet, H. M. Evans, July, 1901; Lake Tenaya, Yosemite, 8,327 feet, Brewer 1691; Tuolumne meadows, in forest, 8,600 feet, Smiley 826; Mt. Surprise, Mariposa County, Congdon, August 11, 1890; Mt. Silliman, Tulare County, 10,000 feet, Mrs. Brandegee, August 23, 1905; near Mineral King, Dudley 2568; Farewell Gap, R. Hopping 87; same locality, 10–10,600 feet, Purpus 2051; same locality, 10,000 feet, Coville and Funston 1746 (co-type in U. C.).

8. **Lupinus obtusilobus** Heller, Muhl., vol. 8, p. 115. 1912.

Type locality.—"On Mt. Shasta, at an altitude of 8,000 feet."

Range.—Mountains of northern California and extending to the northern limits of the Sierra Nevada.

Zone.—Canadian.

Specimens examined.—Summits back of Jameson Lake, on line between Plumas and Sierra Counties, Hall 9351.

9. **Lupinus albicaulis** Dougl. *in* Hook., Fl. Bor. Am., vol. 1, p. 165. 1830.

L. apertus Heller, Muhl., vol. 8, p. 103. 1912.

Type locality.—"About Fort Vancouver on the Columbia."

Range.—Pacific Coast from Washington to southern Sierra Nevada.

Zone.—Transition and Canadian.

Specimens examined.—Summit, Placer County, 7,000 feet, Heller 6978; Gold Lake, Sierra County, 6,400 feet, Hall and Babcock 4508; Silver Lake, Amador County, 8,000 feet, Hansen 744; Crescent Lake, Mariposa County, Congdon, August 10, 1890; stony slopes along Soda Creek, Tulare County, 8–9,000 feet, Purpus 5156; Mineral King, Tulare County, 7,800 feet, Coville and Funston 1478.

Our Sierran form of this species, becoming somewhat dwarfed in the higher mountains (= *L. apertus*), appears to connect with the typical north coast form in Oregon and Washington by a series of intergrades, one of which was described by Drew as *L. sylvestris* (Bull. Torr. Bot. Club, vol. 16, p. 150. 1889).

10. **Lupinus meionanthus** Gray, Proc. Am. Acad., vol. 6, p. 522. 1866.

L. montigenus Heller, Muhl., vol. 6, p. 109. 1910.

Type locality.—"Nevada, near Carson City."

Range.—Central Sierra from Lake Tahoe to the Yosemite region.

Zone.—Canadian, rising into the Hudsonian.

Specimens examined.—Summit, Placer County, Kellogg; cañon of Red Clover Creek, Plumas County, 5,000 feet, Hall and Babcock 4449; Castle Peak near the highest point, 9,000 feet, Heller 7084; mountain ridges from Mt. Stanford to Truckee Knob, 8,500 feet, C. F. Sonne 6; near Donner Lake, on sunny slopes, E. L. Greene 400; Mt. Rose, 10,000 feet, Heller 9880; ridge between Desolation Valley and Heather Lake, Tahoe, 8,700 feet, Smiley 183; gravelly slopes north of Suzy Lake, Tahoe, Smiley 173; Pyramid Peak, 9,400 feet, Hall and Chandler 4737; mountains above Coldstream, Sierra County, 7,500 feet, Sonne, August 7, 1887; head of Fall Creek, Ormsby County, Nevada, 2,460 m., Baker 1325; Carson Spur, Alpine County, 8,500 feet, Hansen 743; Rubicon Peak, Eldorado County, 8,200 feet, Smiley 402; summits and slopes east of the Minarets, Mariposa County, Congdon, August 18, 1899.

11. **Lupinus calcaratus** Kellogg, Proc. Calif. Acad., vol. 2, p. 195. 1863.

Type locality.—None given.

Range.—Northern and central Sierra Nevada and east on the mountains of Nevada. Inner slope of the North Coast Range (Tehama County).

Zone.—Transition and Canadian.

Specimens examined.—Mt. Rose, 9–10,000 feet, Kennedy 1187; Carson Spur, Alpine County, 8,500 feet, Hansen 364; trail to Castle Peak, 8,400 feet, Smiley 488; hills around Marlette Lake, east of Lake Tahoe, 8,200 feet, Hall and Chandler 4589; above Glen Alpine, Tahoe, 7,200 feet, Smiley 205; ridges bordering Lake Lucile, Tahoe, Dudley, June 26, 1900; Glen Alpine trail to Mt. Tallac, 9,000 feet, Abrams 4845; Long Lake, Plumas County, 6,700 feet, Hall 9328; Little Truckee River, 6,300 feet, Hall and Babcock 4532; near Frog Lake on Mt. Stanford (Castle Peak), C. F. Sonne, July 31, 1897; Independence Lake, Nevada County, 7,200 feet, Hall and Babcock 4532.

The four collections last cited present a form with smaller flowers grouped in an inflorescence less dense than usual in this species and this variant has been proposed as specifically distinct—*L. silvicola* Heller (Muhl., vol. 6, p. 81. 1910)—a conclusion which to me appears unwarranted both by the vagueness of the characters assigned and the inconstancy with which they appear.

12. **Lupinus laxiflorus** Dougl. Bot. Reg., vol. 14, pl. 1140. 1828.

Type locality.—"In dry, open gravelly plains, about the great rapids of the River Columbia."

Range.—Washington to northern Sierra Nevada.

Zone.—Transition mainly, rarely above.

Specimens examined.—Long Lake, Plumas County, 6,700 feet, Hall 9328 (referred on floral and vegetative characters only, the pods immature); Summit, in dry meadow, 7,000 feet, Smiley 442a.

Both of these collections differ from good *L. laxiflorus* of the Northwest and approach *L. calcaratus* of the Sierra: the short spur of the calyx and the blue flowers in a loose elongated raceme ally them with *L. laxiflorus;* the pointed leaflets and fine silky appressed pubescence are characters of *L. calcaratus.*

Other lupines may reach our lower borders or locally ascend above them, i.e., *L. Andersoni* Wats. (Ebbett's Pass, *Bolander* 2012); *L. Grayi* Wats. (Tenaya Cañon, 7,000 feet, *Smiley* 667), but are not to be considered as components of the boreal flora of the Sierra.

3. HOSACKIA

1. **Hosackia cuprea** (Greene), comb. nov.

Lotus cupreus Greene, Leaflets, vol. 1, p. 74. 1904.

Type locality.—Hockett's meadows, E. Tulare Co., Calif., at 8,600 feet.''

Range.—Southern Sierra Nevada.

Zone.—Canadian?

Specimens examined.—Meadows at head of Belknap Creek, Tulare County, 8,500 feet, H. M. and G. R. Hall 8367; Hockett's meadows, Tulare County, 8,500 feet, Hall and Babcock 5588.

4. ASTRAGALUS

Leaflets prickly pointed, rigid and persistent; pods minute (¼ inch long) ....1. **A. tegetarius**
Leaflets not prickly pointed; pods more than ¼ inch long (except in *A. Austinae.*)
  Pods bladdery-inflated, thin and membranous.
    Pods 2-celled, ovate, more or less puberulent, sessile in the calyx.
      Stems 5–12 inches high; plants sparsely or densely hirsute ....2. **A. lentiginosus**
      Nearly acaulescent and densely canescent ....3. **A. platytropis**
    Pods 1-celled, very obtuse and glabrous, stipitate ....4. **A. Whitneyi**
  Pods scarcely inflated, firm-walled.
    Pods plainly stipitate and ½–1 inch long ....5. **A. Bolanderi**
    Pods sessile in and shorter than the calyx ....6. **A. Austinae**

1. **Astragalus tegetarius** Wats., Bot. King's Exped., p. 76. 1871.

Type locality.—''Peaks of the East Humboldt and Clover Mountains, Nevada.''

Range.—Southwest Montana and Wyoming to Oregon, south to Colorado, Nevada, and California.

Zone.—Arctic-alpine.

Specimens examined.—Mt. Dana, 13,000 feet, Brewer 1736; same locality, near the summit, Chesnut and Drew, July 17, 1889; summit of Mt. Warren, Tuolumne County, Congdon, August 21, 1894.

2. **Astragalus lentiginosus** Dougl., *in* Hook., Fl. Bor. Am., vol. 1, p. 151. 1830.

Phaca lentiginosa (Dougl.) Piper, Contr. Nat. Herb., vol. 11, p. 368. 1906.

Type locality.—''Subalpine ranges of the Blue Mountains.''

Range.—Washington to California and Nevada, on the inner side of the Cascade-Sierra axis.

Zone.—Canadian as to the Californian specimens.

Specimens examined.—Mono Pass, Congdon, August 26, 1895; mountains near Sonora Pass, 9,000 feet, Brewer 1878.

Piper (*l.c.*) reports this species as Upper Sonoran in zonal position in Washington.

3. **Astragalus platytropis** Gray, Proc. Am. Acad., vol. 6, p. 526.

Type locality.—"Dry rocky mountain near Sonora Pass—in loose gravel and sand near the summit (alt. 10,000 feet)."

Range.—Southwestern Montana across the northern half of the Great Basin to the Sierra Nevada.

Specimen examined.—Mountain summit near Sonora Pass, 10,000 feet, Brewer 1889.

4. **Astragalus Whitneyi** Gray, Proc. Am. Acad., vol. 6, p. 526. 1866.

Type locality—"Dry rocky mountain near Sonora Pass—in loose soil, near the summit, alt. 10,000 feet."

Range.—Sierra Nevada in the northern and central part.

Zone.—Hudsonian and Arctic-alpine.

Specimens examined.—Castle Peak, near the highest point, 9,000 feet, Heller 7101; Mt. Rose, 10,300 feet, Heller 10650; same locality, 10,800 feet, Heller 9937; mountain near Sonora Pass, 10,000 feet, Brewer 1886; Ebbett's Pass, growing on Silver Mountain, Hooker and Gray in 1877; Mt. Warren, Tuolumne County, summit, Congdon, August 21, 1894; Rubicon Peak, Tahoe, 9,100 feet, Smiley 410.

4a. **Astragalus Whitneyi** var. **pinosus** Elmer, Bot. Gaz., vol. 39, p. 54. 1905.

Type locality.—"Summit of Mt. Pinos, Ventura County, California."

Range.—Tehachapi Mountains; southern Sierra Nevada?

Zone.—Canadian.

Specimen examined.—Summit of Mt. Pinos, 8,800 feet, Dudley and Lamb 4588.

Astragalus Whitneyi is very close to *A. Hookerianus* Gray (*l.c.*, p. 215), a species of eastern Washington, Oregon, and Idaho, and perhaps reaching the northern Sierra Nevada in Plumas County (top of Diamond Mountain, near Susanville, 7,300 feet, M. E. Jones, June 28, 1897, perhaps *A. Hookerianus*); the chief difference between the species is the difference in the size of the pods, which in *A. Whitneyi* is an inch or less long, in the other species usually nearly twice as long.

5. **Astragalus Bolanderi** Gray, Proc. Am. Acad., vol. 7, p. 337. 1867.

Type locality.—"Dry ground, at Ostrander's Ranch, Yosemite Valley."

Range.—Sierra Nevada.

Zone.—Canadian mainly.

Specimens examined.—Nevada County, 8,000 feet, A. M. Carpenter, August-September, 1893; Pyramid Peak, 9,500 feet, Hall and Chandler 4731; near Meadow Lakes, Nevada County, C. F. Sonne, August 2, 1892; Eagle Peak meadows, Yosemite, 7,250 feet, Hall 9191; Ostranders, above Yosemite, Bolander 5021; Crescent Lake, Mariposa County, Congdon, August 13–14, 1895; mountains near Soda Creek, 10–11,000 feet, Purpus 5122; Mt. Silliman, Tulare County, Mrs. Brandegee, August 24, 1905; Alta Mountains, Tulare County, R. Hopping 64.

6. **Astragalus Austinae** Gray, Bot. Calif., vol. 1, p. 156. 1880.

Type locality.—"Summit of Mount Stanford (Castle Peak), Nevada Co., at 9,000 feet."

Range.—Mountains of Nevada County.

Zone.—Hudsonian.

Specimens examined.—Mt. Stanford, high ridges, C. F. Sonne, July, 1892; Castle Peak, gravelly slide rock, 8,800 feet, Smiley 480.

Though the genus *Oxytropis* is not represented in the Sierra, one species, *O. oreophila* Gray (Proc. Am. Acad., vol. 20, p. 3. 1884), is a component of the alpine floras of the mountains of Utah and reappears upon the summits of the San Bernardino Mountains in southern California; it is not improbable that it will yet be found in the alpine region of the southern Sierra Nevada.

32. GERANIACEAE (Geranium Family)

1. GERANIUM

1. **Geranium Richardsonii** F. and M., Ind. Sem. Hort. Petrop., vol. 4, p. 37. 1838.

G. albiflorum Hook., Fl. Bor. Am., vol. 1, p. 116. 1831, nor of Ledeb. 1831.
G. Hookerianum Walp., Rep., vol. 1, p. 450. 1842.
G. pentagynum Engelm., *in* Wisliz., Tour. N. Mex., p. 90. 1848.
G. gracilentum Greene, *in* Rydb., Fl. Colo., p. 218. 1906.

Type locality.—"Valleys in the Rocky Mountains."

Range.—Saskatchewan to New Mexico, west through Wyoming and southern Idaho to California; Sierra Nevada and mountains of southern California.

Zone.—Transition and Canadian.

Specimens examined.—North side of Donner Lake, Heller 6997; Tioga Road, vicinity of White Wolf, 8,000 feet, Smiley 885; Indian Creek, Yosemite, 7,200 feet, Hall 9178; above Dark Hole, Yosemite, 7,750 feet, H. M. Evans, July, 1901; Hockett's meadows, Tulare County, Culbertson (B 4382); Hillside above Round meadow, Fresno County, 7,500 feet, Smiley 590.

33. LINACEAE (Flax Family)

1. LINUM

1. **Linum Lewisii** Pursh., Fl. Am. Sept., p. 210. 1814.

L. Sibiricum var. *Lewisii* Lindl., Bot. Reg., vol. 14, pl. 1163. 1828.
L. perenne var. *Lewisii* Eat. and Wright, N. Am. Bot., p. 302. 1840.
L. decurrens Kellogg, Proc. Calif. Acad., vol. 3, p. 44. 1863.
L. Lyallanum Alefeld, Bot. Zeit., vol. 25, p. 251. 1867.

Type locality.—"In the valleys of the Rocky Mountains and on the banks of the Missouri."

Range.—Alaska to Hudson Bay south to California, Arizona, New Mexico aud west Texas.

Zone.—Arid Transition and rising in the mountains to above timber line.

Specimens examined.—Head of Fall Freek, Ormsby County, 2460 m., Baker 1329; near Truckee, Dudley, June 11, 1893; Mt. Lola, west of Tahoe, Kennedy and Doten 187; Tioga Pass, Yosemite, 9,900 feet, Smiley 823; South Fork of San Joaquin, 9,000 feet, Hall and Chandler 718; Mt. Whitney, alpine zone, 11,600 feet, H. M. and G. R. Hall 8432; between Farewell Gap and Mineral King, Tulare County, Dudley 1140; Farewell Gap, Tulare County, Culbertson (B 4561, 4589); mountains near Little Kern River, gravelly slopes, 9–10,000 feet, Purpus 2022; White Chief Mine, timber line near Mineral King, Hall and Babcock 5657.

34. CALLITRICHACEAE (WATER STARWORT FAMILY)

1. CALLITRICHE

1. **Callitriche stenocarpa** Hegelm., Bot. Verein Brandenb., vol. 10, p. 114. 1868.

Type locality.—"Searsville, [California]."

Range.—Oregon and California?

Zone.—Canadian?

Specimens examined.—Silver Lake, Amador County, 8,000 feet, Hansen 729; Forks of Kern River, Tulare County, 10,000 feet, Dudley 2367; Upper Volcano meadow, south of Mt. Whitney, Dudley 2492.

35. ACERACEAE (MAPLE FAMILY)

1. ACER

1. **Acer. glabrum** Torr. var. **Torreyi** (Greene), comb. nov.

A. torreyi Greene, Pitt., vol. 5, p. 2. 1902.

Type locality.—"Californian Sierra at middle altitudes."

Range.—California north to Oregon.

Zone.—Transition and Canadian.

Specimens examined.—Above Donner Lake toward Donner Pass, Heller 7043; Fallen Leaf trail to Mt. Tallac, 8,000 feet, Abrams 4828; Glen Alpine, Tahoe, 6,800 feet, McGregor 176; below Lake Lucile, Tahoe, Dudley, June 26, 1900; Yosemite, J. M. Hutchings in 1890; Pyramid Peak, Tahoe, 8,900 feet, Smiley 111; Sequoia National Park, near Wolverton Creek, Tulare County, A. Davidson 1694.

1a. **Acer glabrum** var. **diffusum** (Greene), comb. nov.

A. diffusum Greene, Pitt., vol. 5, p. 2. 1902.
A. bernardinum Abrams, Torreya, vol. 7, p. 219. 1907.

Type locality.—"Near the summit of the West Humboldt Mountains, Nevada."

Range.—Mountains of Nevada and the Sierra Nevada.

Zone.—Hudsonian.

Specimens examined.—Whitney Creek, Tulare County, Culbertson (B 4554); Kern Cañon tributary, Culbertson (B 4678).

This is the maple of widest range in the west and several attempts have been made to define specifically its many forms, as yet with unsatisfactory results. Pax, in working up his revision (Pflanzenr., Bd. 4, no. 163—Aceraceae), saw reason to change his earlier opinion that it was possible to keep *A. glabrum* Torr. and *A. Douglasii* Hook. separate; ultimately he reduced to the synonymy of *A. glabrum* all of the segregates which have been proposed since the publication of that species and also considered *A. tripartitum* Nutt. (*in* T. and G., Fl., vol. 1, p. 246. 1838) as impossible of definition as a species. He proposes to recognize two varieties: var. *monophyllum* Graf von Schwerin (in Gartenfl., vol. 42, p. 650. 1893), with the leaves lobed but not divided, and var. *tripartitum* (Nutt.) Pax (Engler's Jahrb., vol. 7, p. 218. 1886). This scheme recognizes the distinctness of the Rocky Mountain shrub, which has its foliage normally 3-foliate, a geographical variety which Professor M. E. Jones perceived and expressed in the same combination some seven years before Pax's revision of the family appeared (see Jones, Proc. Calif. Acad. II, vol. 5, p. 627. 1895). But this twofold division among the forms of *A. glabrum* places our Sierran shrub with the variant common in the Northwest; this form of Washington, Idaho, and adjacent Oregon has the leaves shallowly lobed, the angles between the median terminal lobe and the lateral lobes approximating right angles. This appears to be a good geographical race with a fairly well delimited area and to express its relationship to the larger specific unit, Professor C. V. Piper[114] proposed the combination *A. glabrum douglasii* (Hook.), but this shrub most nearly conforms to the plant described by Dr. Torrey as the species *A. glabrum.* If this species is to be retained, and it must be since the priority of the name is unquestioned, the variant of the Northwest should be so known. Our Sierran form differs from this type species in having the leaf far more deeply lobed, the angles being reëntrant, the sinuses sometimes so produced as to give the leaf an appearance not unlike that of the var. *tripartitum* in extreme cases. This Sierran variant Dr. Greene described as *A. torreyi,* but both its characters and geographical position indicate that it should be regarded as a var. *Torreyi,* coördinate with the other two varieties.

In addition to these three varieties, which express the horizontal distribution of *A. glabrum* Torr., there is also a well-marked high mountain variety, distinguished by greatly reduced leaves, short spinescent branches and very white bark, and which of all the segregates proposed, would have, in my opinion, the best claim to be regarded as a species, but which is united to the lower altitude varieties by numerous intergrades. This nearly alpine shrub—*A. diffusum* Greene—was described from collections made "near the summit of the West Humboldt Mountains," but is now known to grow in the Sierra Nevada.

36. RHAMNACEAE (Buckthorn Family)

1. CEANOTHUS

Leaves 1–3 inches long, ½–2.5 inches broad, deep green and shining-glutinous above, pale and minutely pubescent below; large shrub with ascending green branches .... 1. **C. velutinus**

Leaves ½–1.5 inches long, ¼–1 inch broad, more or less cordate at base; depressed shrub forming broad mats; branches light gray .. 2. **C. cordulatus**

1. **Ceanothus velutinus** Dougl. *in* Hook., Fl. Bor. Am., vol. 1, p. 125. 1830.

Type locality.—"Subalpine hills near the source of the Columbia; and at the Kettle Falls."

Range.—Washington to California, east to Colorado and Black Hills.

Zone.—Transition and Canadian.

Specimens examined.—Donner, Placer County, Brandegee, July, 1889; upper end of Donner Lake, Heller 6968; lateral moraine south of Fallen Leaf Lake, 6,800 feet, Abrams 4792; Angora Peak, Tahoe, 7,000 feet, Smiley 24a; Mt. Tallac, east side in slide rock, 8,000 feet, Smiley 242; Sonora Pass, 8–9,000 feet, Brewer 1877; Kern Cañon, Tulare County, 9,000 feet, H. M. and G. R. Hall 3455.

2. **Ceanothus cordulatus** Kellogg, Proc. Calif. Acad., vol. 2, p. 124. 1861.

Type locality.—"Brought by Dr. J. A. Veatch from Washoe."

Range.—Mountains of northern California, and southern Oregon. south through the Sierra Nevada to southern California.

Zone.—Upper Transition and Canadian.

Specimens examined.—Plumas County, Mrs. Austin; Fallen Leaf Lake, Tahoe, growing almost flat upon the ground, Miss Lathrop, July 12, 1909; Mt. Tallac, 8,100 feet, Smiley 241; Angora Peak, 7,800 feet, Smiley 43; Grass Lake, Tahoe, McGregor 87; Mt. Tallac, near top of talus slope on east side, forming part of a large mat 9 feet across, Smiley 243; Tuolumne meadows, prostrate and spreading on exposed ledges, 8,700 feet, R. A. Ware 2644c; near Sonora Pass, common and spreading on the ground, Brewer 1926; between Lake Tenaya and Tuolumne meadows, 8,300 feet, Smiley 704; Cloud's Rest trail, 7,200 feet, Smiley 519; ridge above Round meadow, Fresno County, 7,800 feet, Smiley 591; Mt. Olancha, Tulare County, 8–10,000 feet, Rothrock 354.

37. MALVACEAE (Mallow Family)

1. SIDALCEA

- Flowers loosely disposed in elongated racemes; achenes reticulated but not pubescent.
  - Stems creeping and rooting at the nodes; stems and petioles with long hispid hairs .... 1. **S. reptans**
  - Stems erect.
    - Plant glaucous and nearly smooth .... 2. **S. glaucescens**
    - Plant greenish and scabrid with short stiff forked hairs .... 3. **S. asprella**
- Flowers small and densely spicate in usually short inflorescences; the lower petioles with long spreading hairs; achenes pubescent, not reticulated .... 4. **S. spicata**

1. **Sidalcea reptans** Greene, Pitt., vol. 3, p. 159. 1897.

S. favosa Congdon, Erythea, vol. 7, p. 183. 1900.

Type locality.—"In marshy ground, Panther Creek, Amador County, California."

Range.—Sierra Nevada.

Zone.—Upper Transition and Canadian.

Specimens examined.—Near Jackass meadows, Upper San Joaquin River, Congdon, August 16, 1895; Shuteye Mountain, Madera County, 6,500 feet, J. Murdoch Jr. 2512.

2. **Sidalcea glaucescens** Greene, Bull. Calif. Acad., vol. 1, p. 77. 1885.

Type locality.—"Summit Station, in the neighborhood of Donner Lake."

Range.—Mountains of California from Mt. Shasta to the southern Sierra Nevada. See note below.

Zone.—Transition and Canadian.

Specimens examined.—Summit, Heller 7047; same locality, E. L. Greene, August, 1884; near Donner Lake, Torrey 54; Sierra County, Lemmon in 1874; Summit, dry border of meadow, 7,100 feet, Smiley 452; Hermit Valley, Alpine County, Hooker and Gray in 1877; same locality, 8,000 feet, Hall and Chandler 4772; near Dark Hole, Yosemite, 7,700 feet, Smiley 884; wet places on Middle Tule River, Tulare County, 8–9,000 feet, Purpus 5184.

The range of this species should be considerably extended according to Gray (Proc. Am. Acad., vol. 22, p. 287): "It abounds in the higher Sierra Nevada, extends east to Utah, and northward apparently even to British Columbia." This species is not included in Professor Piper's Flora of Washington (Contr. Nat. Herb., vol. 11) though the Synoptical Flora (vol. 1, pt. 1, p. 306) reaffirms Dr. Gray's statement as to the range and cites a collection made by *Fletcher* from near Victoria, British Columbia. No specimens certainly referable to this species have been seen by me beyond the limits assigned above.

3. **Sidalcea asprella** Greene, Bull. Calif. Acad., vol. 1, p. 78. 1885.

S. montana Congdon, Erythea, vol. 7, p. 183. 1900.

Type locality.—"El Dorado County" and "near Camptonville, in Yuba County."

No specimens referable to this species have been seen by me from the boreal region and it is here included only because Dr. H. M. Hall (Univ. Calif. Publ. Bot., vol. 4, p. 200. 1912), after examination of type material of *S. montana,* determined the synonymy as above given. I have had no opportunity for making the comparison myself. If the identity of these species, as determined by Dr. Hall, shall be confirmed when more abundant material is available, *S. asprella* will be found to have a somewhat remarkable altitudinal range. Dr. Greene says of his species, it grows "on bushy hillsides of the lower Sierra, just below the habitat of *Chamaebatia* (*C. foliolosa* Benth.)," that is, in the Upper Sonoran life-zone; on the other hand, the type locality for *S. montana* is given "In granite sand, in the high Sierras east of the Minarets, at 11,000 ft."

4. **Sidalcea spicata** (Regel) Greene, Bull. Calif. Acad., vol. 1, p. 76. 1885.

Callirhoe spicata Regel, Gartenfl. vol. 21, p. 291. 1872.
S. ranunculacea Greene, Leaflets, vol. 1, p. 75. 1904.
S. interrupta Greene, *l.c.*

Type locality.—Regel's description was made from plants grown in Europe from seed collected "in der Sierra Nevada Californiens."

Range.—Sierra Nevada northward to central Oregon.

Zone.—Upper Transition and Canadian.

Specimens examined.—Summit Camp, Kellogg, July 14, 1870; lower end of Donner Lake, Heller 6898; near Glen Alpine, Tahoe, Miss Lathrop, July 19, 1909; marshy woods near Lilly Lake, Tahoe, 6,600 feet, Smiley 325; near Suzy Lake trail from Glen Alpine, 7,500 feet, Smiley 188; Hope Valley, Alpine County, Hansen 505; Snow Creek trail to Lake Tenaya, Yosemite, 7,700 feet, Smiley 672; Mineral King, Brandegee in 1892; Hockett's meadows, Tulare County, Culbertson (B 4318); north side of Toowa Range, Tulare County, 9,000 feet, H. M. and G. R. Hall 8404.

38. HYPERICACEAE (St. John's-wort Family)

1. HYPERICUM

1. **Hypericum anagalloides** C. and S., Linnaea, vol. 3, p. 127. 1828.

H. anagalloides var. *pumilum* R. Keller, Bull. Herb. Boissier II, vol. 8, p. 187. 1908.

Type locality.—"Ad portum St. Francisci Californiae."

Range.—Pacific Coast from British Columbia to California and east to Montana.

Zone.—Transition to Hudsonian, in wet meadows.

Specimens examined.—Glen Alpine, Tahoe, McGregor 19; Suzy Lake, Tahoe, 7,600 feet, Smiley 202; near Snow Flat, Yosemite, 8,700 feet, H. M. Evans, July, 1901; Elizabeth Lake meadow, above Tuolumne meadows, 9,800 feet, Smiley 801; Tuolumne meadows, moist ground by the river, 8,600 feet, R. A. Ware 2629c.

39. VIOLACEAE (Violet Family)

1. VIOLA

Plants stemless, the leaves and scapes arising from horizontal rootstocks; nearly glabrous dwarf of wet meadows with small white flowers, the petals very thin and translucent .... 1. **V. Macloskeyi**
Plants with erect leafy stems.
  Puberulent or nearly glabrous; peduncles usually exceeding the leaves; flowers violet-purple or white .... 2. **V. adunca**
  Leaves and stems conspicuously pubescent; peduncles little, if at all, exceeding the leaves.
    Leaves coarsely toothed or some entire, usually some with purple veins; flowers light yellow or sometimes ochre-colored tinged with purple; capsule pubescent .... 3. **V. purpurea**
    Leaves entire or merely repandly undulate, densely canescent below, green veined; flowers bright yellow; capsule glabrous or sparingly pubescent .... 4. **V. praemorsa**

1. **Viola Macloskeyi** Lloyd, Erythea, vol. 3, p. 74. 1895.

Type locality.—"Mossy, springy places in the Cascades, Oregon."

Range.—British Columbia to California and Colorado.

Zone.—Canadian and Hudsonian in wet meadows.

Specimens examined.—Glen Alpine, Tahoe, Chesnut and Drew, August 16, 1890; Half-Moon Lake, Tahoe, 7,760 feet, McGregor 161; Heather Lake, wet meadow below the lake, 8,000 feet, Smiley 158; Pyramid Peak, 7,000 feet, W. S. Atkinson in 1900; Corral Springs, Amador County, 7,000 feet, Hansen 545; about Marlette Lake, east of Tahoe, 2460 m., Baker 1289; White Wolf, Yosemite, 8,000 feet,

H. M. Evans, July, 1901; Dana Fork meadows, Yosemite, 9,000 feet, Smiley 846; meadows near Mt. Dana, McLean, July 4, 1875; Peregoy's, above Yosemite, 7,000 feet, A. Gray in 1872; head of South Fork of the San Joaquin, 10–10,800 feet, Hall and Chandler 710; Shuteye Mountain, Billy Brown meadows, 6,500 feet, J. Murdoch Jr. 2506; Nellie Lake meadow, Fresno County, 8,700 feet, Smiley 603; Farewell Gap, Tulare County, 10,400 feet, Purpus 5666; Hockett's meadows, Tulare County, Dudley 1890.

2. **Viola adunca** Smith, *in* Rees' Cycl., vol. 37, no. 63. 1817.

V. longipes Nutt., *in* T. and G., Fl., vol. 1, p. 140. 1838.
V. canina var. *adunca* A. Gray, Proc. Am. Acad., vol. 8, p. 377. 1872.
V. canina var. *oxyceras* Wats., Bot. Calif., vol. 1, p. 56. 1876.

Type locality.—"From the west coast of North America."

Range.—Pacific Coast from Alaska to southern California.

Zone.—Transition to Hudsonian.

Specimens examined.—Pyramid Peak, W. S. Atkinson in 1900; Plumas County, Mrs. Austin, May, 1877; White Wolf, Yosemite, 8,000 feet, H. M. Evans, July, 1901; Porcupine Flat, Mariposa County, 8,100 feet, R. A. Ware 2602c; Tuolumne meadows, 8,600 feet, R. A. Ware 2601e; stream bank below Elizabeth Lake, above Tuolumne meadows, 8,700 feet, Smiley 813; Yosemite trail, Bolander 1632; near Peregoy's above Yosemite, A. Gray in 1872; Bear Creek, Fresno County, 7,300 feet, Hall and Chandler 399; High Sierra about Mt. Brewer, Tulare County, Brewer 2807; valley of King's River, Coville and Funston 1859.

3. **Viola purpurea** Kellogg, Proc. Calif. Acad., vol. 1, p. 56. 1855.

V. aurea Kellogg, Proc. Calif. Acad., vol. 2, p. 185. 1863.
V. aurea venosa Wats., Bot. Calif., vol. 1, p. 56. 1876.
V. Nuttallii var. *venosa* Wats., Bot. King's Exped., p. 35. 1871.

Type locality.—Not given.

Range.—Pacific Coast from British Columbia to southern Sierra Nevada, east to Utah, perhaps to Colorado.

Zone.—Canadian and Hudsonian.

Specimens examined.—Castle Peak near the highest point, Heller 7089; Sierra, moraines at 7–9,000 feet, J. Muir; above Ciseo, Watson in 1867; peak above Mono Lake, 10,500 feet, Brewer 1797; Summit, in dry sandy meadow, 7,000 feet, Smiley 435; near Lake Tenaya, Yosemite, dry bank, at 8,200 feet, Smiley 867; slope of Alta Peak, Tulare County, Dudley 1546.

3a. **Viola purpurea** var. **pinetorum** Greene, Fl. Fran., p. 243. 1891.

V. pinetorum Greene, Pitt., vol. 2, p. 14. 1889.

Type locality.—"Pine woods of the higher mountains south of Tehachapi, Kern Co., California."

Range.—Mountains of central and southern California; extending north into Oregon? Wooton and Standley (Contr. Nat. Herb., vol. 19, p. 430) identify a violet collected in northern New Mexico with this variety.

Zone.—Arid Transition and Canadian.

Specimens examined.—Summit, 7,000 feet, Heller 9836; above Independence Lake, 7,500 feet, Hall and Babcock 4540; Lily Lake, Tahoe, in forest of *Pinus Jeffreyi,* 6,700 feet, Smiley 318; near White Wolf, Yosemite, 8,000 feet, H. M. Evans, July, 1901; Mt. Lola, Tahoe, Kennedy and Doten 178; near Mt. Dana, dry slopes, 9–10,000 feet, Brewer; Tuolumne meadows, open pine forest, 8,600 feet, R. A. Ware 2600c; hillside above Soda Springs, Yosemite, 7,400 feet, Smiley 455; Bonita meadow, dry open pine forests, 8,500 feet, Hall and Babcock 5189; Kaweah Peaks region, Tulare County, Dudley 2411; Mt. Olancha, Tulare County, 11,000 feet, Hall and Babcock 5235.

This variety is feebly distinguished from the species by having leaves usually more deeply toothed and an increase in the amount of pubescence.

4. **Viola praemorsa** Doug., *in* Lindl., Bot. Reg., vol. 15, pl. 1254. 1829.

Type locality.—"In dry upland soils, under the shade of solitary pine trees on the banks of the Columbia, and the plains of the river Aquilar, in California."

Range.—California to Washington and Idaho.

Zone.—Arid Transition and above in a dwarf state in the Canadian.

Specimens examined.—Summit, Placer County, 7,000 feet, Heller 9859; Crescent Lake, Mariposa County, Congdon, August, 1890.

40. HALORAGIDACEAE (Water Milfoil Family)

1. HIPPURIS

1. **Hippuris vulgaris** L., Sp. Pl., p. 4. 1753.

Type locality.—"Habitat in Europae fontibus."

Range.—Holarctic realm; in America south to New England, New York, Indiana, Nebraska, New Mexico, and California.

Zone.—Transition and Canadian.

Specimens examined.—Lily Lake, Tahoe, 6,600 feet, Smiley 329; Tuolumne meadows, Yosemite, in pools behind Parsons Lodge, 8,600 feet, Smiley 748.

41. ONAGRACEAE (Evening Primrose Family)

Fruit indehiscent, 1–2 seeded, and bristly with hooked hairs; flowers 2-merous .... 1. **Circaea**
Fruit a many seeded capsule opening by valves; flowers 4-merous. Seeds without a coma .... 2. **Oenothera**
  Seeds comose (i.e. with a tuft of hairs at one end).
    Calyx green, herbaceous .... 3. **Epilobium**
    Calyx deep red or purple .... 4. **Zauschneria**

1. CIRCAEA

1. **Circaea alpina** L., Sp. Pl., p. 9. 1753.

Type locality.—"Habitat ad radices montium in frigidis Europae."

Range.—Holarctic realm; in America south in the Appalachians to Georgia; in the Rocky Mountains to New Mexico; and in the Cascade-Sierra axis to California?

Zone.—Canadian.

Specimen examined.—Pyramid Peak, Brewer 2133; this specimen has been referred to *C. pacifica* A. and M. (Bot. Zeit., vol. 29, p. 392. 1871), a common species in the Transition Zone in the Sierra, but examination shows the racemes bracted and leaves toothed as in the more northern and eastern form; more material is necessary before fully accepting *C. alpina* as a species of our boreal flora.

2. OENOTHERA

1. **Oenothera xylocarpa** Coville, Contr. Nat. Herb., vol. 4, p. 105. 1893.

Type locality.—"On the west side of Whitney meadows, Sierra Nevada, Tulare County, California."

Range.—Southern Sierra Nevada.

Zone.—Canadian.

Specimens examined.—Volcano meadows (formerly called Whitney meadows), Hall and Babcock 5489; Fish Creek, Tulare County, 8,500 feet, Hall and Babcock 5214; north side of Toowa Range, Tulare County, 9,800 feet, H. M. and G. R. Hall 8402; sandy plains about Whitney meadows, 9–10,000 feet, Purpus 1386.

3. EPILOBIUM

Leaves pale and glaucous or covered with whitish bloom.
  Leaves broadly ovate, repand denticulate; flowers large, petals ½ inch or longer, deeply lobed .... 1. **E. obcordatum**
  Leaves oblong-lanceolate, repand denticulate or nearly entire; flowers small, petals about ⅙ inch long, merely notched .... 2. **E. glaberrimum**
Leaves green, not glaucous nor covered with bloom.
  Leaves small (few more than ¾ inch long).
    Plants crisp-hairy throughout .... 3. **E. ursinum** var. **falcatum**
    Plants glabrous or at most minutely glandular-puberulent above.
      Stems decumbent with nodding tip and leafy to the top; leaves, at least the lowest, wing-petioled .... 4. **E. anagallidifolium**
      Stems erect to the summit with the leaves remote above, crowded below; leaves somewhat tapering at base, but not petioled .... 5. **E. oregonense**
  Leaves larger (mostly over ¾ inch long).
    Leaves all sessile .... 6. **E. brevistylum**
    Leaves petioled.
      Leaves ovate, acute, dark green, the upper longer than the internodes; flowers pink or violet .... 7. **E. Hornemanni**
      Leaves ovate-spatulate, obtuse, thin and light green, shorter than the internodes; flowers white or pale pink .... 8. **E. alpinum**

1. **Epilobium obcordatum** Gray, Proc. Am. Acad., vol. 6, p. 532. 1866.

Type locality.—In the Sierra Nevada, at Squaw Valley and Ebbett's Passes, alt. 8,000–8,500 feet."

Range.—Sierra Nevada north and east to Mt. Shasta, and mountains of central Oregon (Idaho?); on the East Humboldt Mountains, Nevada.

Zone.—Arctic-alpine and Hudsonian.

Specimens examined.—Butte Mountain, northern Butte County, 6,800 feet, Hall 9793; Mt. Stanford (Castle Peak), Bolander in 1873; same locality, Hooker and Gray in 1877; high mountain near Donner Pass, Torrey 114; Carson Spur, Alpine County, 8,500 feet, Hansen 298; rocky flat in Placer County, 6,900 feet, A. M. Carpenter, August-October, 1892; summit back of Jonesville, Butte County, 7,000 feet, Heller 11659; Ebbett's Pass, Brewer 1997; Squaw Valley Pass, Brewer 2163; near summit of Devil's Cliff, Summit Soda Springs, Kennedy and Doten 276; south base of Mt. Hoffman, Yosemite, 8,200 feet, Hall and Babcock 3482; Rubicon Peak, Tahoe, rocky ledges, 8,700 feet, Smiley 404; on Truckee River near Knoxville, 8,800 feet, Brewer 2163 (no doubt a duplicate of no. 2163 above, but included since the locality is different as given on the label in U. C.); Red Mountain, 11,000 feet, J. Muir in 1872; Farewell Gap, Tulare County, 10,000 feet, R. Hopping 159; Mt. Whitney, 12–13,000 feet, Purpus 1700; North Fork of Kern River, Tulare County, 12,000 feet, Rothrock 400; trail to Mt. Whitney and Siberian Peak, Culbertson (B 4328); summit of Farewell Gap, 10,400 feet, Hall and Babcock 5662; Arroyo-Kern Divide, Tulare County, Dudley, August 2, 1897.

This species of *Epilobium* is the distinctive Sierran member of the genus and interesting, as Dr. Gray pointed out when describing it, as connecting the *Chamaenerion* section with the rest of the genus.

2. **Epilobium glaberrimum** Barbey, *in* Brewer and Wats., Bot. Calif., vol. 1, p. 220. 1876.

E. fastigiatum var. *glaberrimum* (Barbey) Piper, Contr. Nat. Herb., vol. 11, p. 404. 1906.

Type locality.—"In the Sierra Nevada: Yosemite Valley."

Range.—Pacific Coast from Washington to California (King's River region), east to the Great Basin ranges in Nevada.

Zone.—Canadian, rising into the Hudsonian.

Specimens examined.—North side of Donner Lake in a hillside swamp, Heller 6998; Mt. Dyer, Plumas County, Mrs. R. M. Austin, July, 1879; Mt. Stanford (Castle Peak), Hooker and Gray in 1877 (possibly better referred to the var. *latifolium* Barbey, *l.c.*); Half-Moon Lake, Tahoe, 7,760 feet, McGregor 65; Farewell Gap, Tulare County, 10,400 feet, Purpus 5152a; Little Kern River, along brooks at 9–10,000 feet, Purpus 5152.

3. **Epilobium ursinum** Parish var. **subfalcatum** Trelease, Rep. Mo. Bot. Gard., vol. 2, p. 101. 1891.

Type locality.—Not given.

Range.—Sierra Nevada northward to Washington?

Specimens examined.—Silver Lake, Amador County, 8,000 feet, Hansen 306; slope above Gilmore Lake, west side of Mt. Tallac, Tahoe, 8,500 feet, Smiley 373.

The type species, *E. ursinum* Parish in Trelease (*l.c.*), was described from the mountains of southern California, but is present in the Sierra, growing in the Transition zone and rising locally to the edge of the Canadian (Snow Creek, Yosemite, 6,500 feet, Smiley 659; Round meadow, Fresno County, 7,300 feet, Smiley 587).

4. **Epilobium anagallidifolium** Lam. Encyc., vol. 2, p. 376. 1786.

Type locality.—"Mont-d'Or."

Range.—Holarctic realm; in America south to Quebec, northern New England (?), Colorado and California.

Zone.—Arctic-alpine.

Specimens examined.—Wet meadows, Farewell Gap, Tulare County, 10,400 feet, Purpus 5668; Mt. Silliman, Tulare County, Mrs. Brandegee, August 22, 1905; Ebbett's Pass, Brewer 1891, the specimen in poor condition and not certainly determined as of this species, perhaps of no. 8.

5. **Epilobium oregonense** Hausskn., Monogr., p. 276. 1884.

Type locality—"Oregon in alpinis."

Range.—Pacific Coast from Washington to California; at the northeast to Idaho.

Zone.—Transition and Canadian.

Specimens examined.—Little Valley, Ormsby County, Nevada, 2,000–2,155 m., Baker 1357; Sierra Valley, Lemmon in 1873.

5a. **Epilobium oregonense** var. **gracillimum** Trelease, *l.c.*, p. 109.

E. Pringleanum Hausskn., Mitt. geogr. Gesellsch. Jena, vol. 7, p. 5. 1888.

Type locality.—"Bogs, Strawberry Valley, California."

Range.——Same as the species.

Zone.—Canadian.

Specimens examined.—Near Summit Station, Heller 7030; head of Tuolumne River, 9,000 feet, Brewer 1766; Westfall's meadows, Yosemite, Bolander 4965; shores of Marlette Lake, east of Lake Tahoe, Hall and Chandler 4516.

6. **Epilobium brevistylum** Barbey, *in* Brewer and Wats., Bot. Calif., vol. 1, p. 220. 1876.

Type locality.—"Sierra County," California.

Range.—California to Washington.

Zone.—Canadian.

Specimens examined.—Silver Lake, Amador County, 7,200 feet, E. Mulliken 118; Soquel, Madera County, Congdon, August 11, 1899.

Miss Eastwood[89] reports this species from East Lake, Tulare County.

7. **Epilobium Hornemanni** Reichenb., Icon. Crit., vol. 2, p. 73. 1824.

Type locality.—"In turfosis alpinis Norvegiae."

Range.—Holarctic realm; in America south to New England, Colorado, and California.

Zone.—Hudsonian mainly.

Specimens examined.—Castle Peak, 8,800 feet, Smiley 479; Washoe County, Nevada, south side of Slide Mountain, 7,300 feet, Heller 10,935; Suzy Lake, Tahoe, 7,650 feet, McGregor 105; Lake of the Woods meadow, Tahoe, 8,200 feet, Smiley 54; Velma Lakes, Tahoe, 8,000 feet, Hall 8809; Dana Fork meadows, Yosemite, 9,800 feet, Smiley 856; Mt. Silliman, Tulare County, Mrs. Brandegee, August, 1905.

8. **Epilobium alpinum** L., Sp. Pl., p. 348. 1753.

Type locality.—"Habitat in Alpibus Helveticis, Lapponicis."

Range.—Holarctic realm; in America south to New England, New Mexico, and Cailfornia.

Zone.—Canadian and above.

Specimens examined.—Above Donner Lake toward Donner Pass, Heller 7044; Long Lake, Plumas County, 6,700 feet, Hall 9323; head of Fall Creek, Ormsby County, Nevada, 2,460 m., Baker 1321; Mt. Dana, 10,300 feet, Smiley 715; Lake Tenaya, Yosemite, meadow south of lake, 8,200 feet, Smiley 682; foot of Mt. Dana, Congdon, August 10, 1898; Kaiser Peak, Fresno County, moist ledge on east side of summit, 10,100 feet, Smiley 639; Soda Creek, Tulare County, 8–9,000 feet, Purpus 2018; Alta meadows, Tulare County, Mrs. Brandegee, August, 1905.

Epilobium adenocaulon Hausskn. (Oestr. Bot. Zeitschr., vol. 29, p. 119. 1879), a species of wide range in temperate North America and present in California, occurs in the Sierran region in the Transition and not infrequently rises to our lower boundary (between Lily Lake and Glen Alpine, Tahoe, 6,900 feet, Smiley 394; Tioga Road, Yosemite, between Aspen Valley and White Wolf, 7,000 feet, Smiley 896).

Epilobium saximontanum Hausskn. (*l.c.*), a species of Colorado and Utah, is not certainly known from the Sierra Nevada, though a plant collected upon Castle Peak, in the Hudsonian life-zone, at 8,800 feet, presents characters suggesting that species (*Smiley* 478).

4. ZAUSCHNERIA

1. **Zauschneria latifolia** Greene, Pitt., vol. 1, p. 26. 1887.

Z. californica var. *latifolia* Hook., Bot. Mag., t. 4493. 1850.

Type locality.—Not given. The original description drawn in part from plants grown in England from seed collected in California.

Range.—Southern Sierra Nevada and South Coast Ranges.

Zone.—Arid Transition and rising rarely to timber-line.

Specimens examined.—Mountain slopes along Little Kern River, 9,300 feet, low shrub 10–12 inches high, Purpus 5226; Sardine Cañon, Tulare County, 11,000 feet, Austin 353; Mt. Silliman, Mrs. Brandegee, August 24, 1905.

This species is of interest because it represents a factor in the high mountain flora, whose constituent species have undoubtedly been derived from the endemic genera of the Californian-Mexican region.

Several small annuals, with minute red flowers and seeds without a coma, belonging to the genus *Gayophytum,* are sometimes seen within our borders (i.e., *G. caesium,* Suzy Lake, Tahoe, 7,600 feet, *Smiley* 195; *G. ramosissimum,* Tioga Road, Yosemite, 6,500 feet, *Smiley* 903), but they are essentially Upper Sonoran and Transition species and in no sense an integral part of the boreal Sierran flora. When found, they are always on dry, south or west facing slopes, where the life conditions, *at their season of growth,* are those of lower zones.

42. CORNACEAE (Dogwood Family)

1. CORNUS

1. **Cornus stolonifera** Michx., Fl., vol. 1, p. 92. 1803.

C. alba L., subsp. *stolonifera* (Michx.) Wangerin, Pflanzenr., Bd. 4, Heft 229, s. 53. 1910.

Type locality.—"Hab. ad ripas amniumque rivorumque Canadae et Novae Angliae."

Range.—Subarctic America from the Mackenzie to Gulf of St. Lawrence and south to the Middle Atlantic States, Great Lakes, Iowa, Nebraska, New Mexico, Utah, and California.

Zone.—Transition and Canadian.

Specimens examined.—Above Donner Lake toward Donner Pass, Heller 7045; Summit Valley, 7,500 feet, Pringle 306; road to Glen Alpine, Tahoe, Miss Lathrop, July 19, 1909; near Summit, 7,300 feet, Smiley 458; Suzy Lake, Tahoe, 8,000 feet, Smiley 179.

Cornus canadensis L. extends down the northwest coast as far as Mendocino County and is present in the subalpine floras of the mountains of Washington and in the Rockies to Colorado but absent from the southern Cascades and the Sierra.

43. UMBELLIFERAE (PARSLEY FAMILY)

- Fruit long-linear, cylindrical, more than twelve times longer than broad ....1. **Osmorrhiza**
- Fruit not long-linear, but short-conical or flattened.
  - Fruit with hooked bristles ....2. **Sanicula**
  - Fruit not bristly.
    - Fruit flattened dorsally.
      - Umbellets of free pedicelled flowers.
        - Plants large; leaf bases broadly sheathing.
          - Leaves ternate with leaflets large and angularly lobed ..3. **Heracleum**
          - Leaves quinnate with leaflets long-linear and entire ....4. **Angelica**
        - Plants small and caespitose; leaflets small ....5. **Peucedanum**
      - Umbellets capitate of sessile flowers ....6. **Selinum**
    - Fruit not flattened dorsally but more or less laterally flattened.
      - Stylopodium conical.
        - Stems from a smooth tuber or cluster of tubers ....7. **Eulophus**
        - Stems from a fibrous coated rootstock ....8. **Ligusticum**
      - Stylopodium flat or wanting.
        - Rays 1–4 inches long; plants large ....9. **Pteryxia**
        - Rays very short or nearly obsolete; plants small.
          - Flowers yellow.
            - Fruit densely hispidulous ....10. **Drudeophytum**
            - Fruit glabrous ....11. **Podistera**
          - Flowers purplish ....12. **Aulospermum**

1. OSMORRHIZA

- Fruit bristly on the lower part of the ribs ....1. **O. brevipes**
- Fruit glabrous ....2. **O. occidentalis**

1. **Osmorrhiza brevipes** (C. and R.) Suksdorf, Allg. Bot. Zeitschr., Bd. 12, s. 5. 1906.

Washingtonia brevipes Coult. and Rose., Contr. Nat. Herb., vol. 7, p. 66. 1900.

Type locality.—"Mount Shasta and vicinity, Siskiyou County, Cal."

Range.—Pacific Coast from northern Washington to southern California; Idaho.

Zone.—Transition and lower Canadian.

Specimens examined.—Lateral moraine, Fallen Leaf Lake, 6,500 feet, Abrams 4793; Suzy Lake trail, Tahoe, 7,600 feet, McGregor 123; Little Valley, Ormsby County, Nevada, Baker 1363; Farewell Gap trail, Tulare County, 8,500 feet, Hall and Babcock 5667; Hockett's meadows, Tulare County, Culbertson (B 4387).

2. **Osmorrhiza occidentalis** Torr., Bot. Mex. Bound., p. 71. 1859.

Glycosma occidentalis Nutt., *in* T. and G. Fl., vol. 1, p. 639. 1840.

Type locality.—"Western side of the Blue Mountains of Oregon."

Range.—British Columbia to Alberta and south to California and Colorado.

Zone.—Canadian mainly, occasionally Transition.

Specimens examined.—Webber Lake, S. B. Doten 63; Summit and Cisco, Bolander in 1873; ridge south of Donner Pass, 8,500 feet, Heller 7183; Mono Pass, Bolander 6342; trail from Suzy Lake to Glen Alpine, 7,400 feet, Smiley 181; Bloody Cañon, Mono County, Chesnut and Drew, July 21, 1889; San Joaquin Pass, Madera County, Congdon, August 20, 1895; Mt. Raymond, Madera County, 7,600 feet, Smiley 528.

2. SANICULA

1. **Sanicula septentrionalis** Greene, Erythea, vol. 1, p. 6. 1893.

S. divaricata Greene, Erythea, vol. 3, p. 64. 1895.

Type locality.—"Vancouver Island."

Range.—Central Sierra Nevada to British Columbia and east to Montana.

Zone.—Transition and Canadian.

Specimen examined.—Divide, south of Slide Mountain, Washoe County, Nevada, 8,400 feet, Heller 10966.

The type locality for *S. divaricata* is "Near Castle Peak, above Donner Lake;" the description based upon a collection of Dr. Greene's made in 1893.

According to Wolff (revision of *Sanicula* in Pflanzenr., Bd. 4, Heft 228, s. 75), the range should be extended to southeastern Alaska (Lynn Canal, *A. and E. Krause*).

3. HERACLEUM

1. **Heracleum lanatum** Michx., Fl., vol. 1, p. 166. 1803.

Type locality.—"Canada."

Range.—Newfoundland to southeastern Alaska and south to North Carolina, Central States, New Mexico, and California.

Zone.—Transition and Canadian.

Specimens examined.—Half-Moon Lake, Tahoe, 7,760 feet, McGregor 70; Carson Spur, Alpine County, 8,500 feet, Hansen 757; Cascade Lake, Tahoe, C. J. Fox Jr., July, 1895; Snow Valley, Ormsby County, 2,460–2,615 m., Baker 1439.

4. ANGELICA

1. **Angelica lineariloba** Gray, Proc. Am. Acad., vol. 7, p. 347. 1868.

Type locality.—"Ostrander's Meadows, Yosemite Valley, alt. 8,000 feet."

Range.—Sierra Nevada.

Zone.—Canadian.

Specimens examined.—Mono Pass, 10,000 feet, Bolander 6344; Mineral King, Tulare County, 2,750 m., Coville and Funston 1479; Kern Cañon, 6,500 feet, Tulare County, Hall and Babcock 5564; rocky slopes near Little Kern River, 9–10,000 feet, Purpus 2039; Little Kern River, 8,500 feet, Culbertson (B 4276); southern Sierras, 9,500 feet, Rothrock 355.

5. PEUCEDANUM

1. **Peucedanum Torreyi** Coult. and Rose, Bot. Gaz., vol. 14, p. 276. 1889.

Type locality.—"Yosemite Valley, California."

Range.—Central and southern Sierra Nevada.

Zone.—Canadian.

Specimens examined.—Mt. Moses, Tulare County, 9–10,000 feet, moist rocks, Purpus 1531; Alta Meadows, Tulare County, 10,000 feet, G. B. Grant 704; same locality, Mrs. Brandegee, August 5, 1905.

6. SELINUM

Leaves glabrous	1. S. capitellatum
Leaves scabrid	2. S. eryngiifolium

1. **Selinum capitellatum** Wats., Bot. of Kings Exped., p. 126. 1871.

Sphenosciadium capitellatum Gray, Proc. Am. Acad., vol. 6, p. 537. 1866.

Type locality.—"In the Sierra Nevada, near Ebbett's Pass., alt. 7–8,000 feet."

Range.—Sierra Nevada north to southern Oregon and Idaho, and in Nevada.

Zone.—Transition and Canadian.

Specimens examined.—Plumas County, Mrs. R. M. Austin; Donner Lake, Heller 7148; Cascade Lake, Tahoe, C. J. Fox Jr., July, 1895; near Lily Lake, Tahoe, 6,800 feet, Smiley 316; Ebbett's Pass, Alpine County, 7–8,000 feet, Brewer 2026; Yosemite, C. S. Sargent in 1878; Coyote Creek, Tulare County, Culbertson (B 4364).

Selinum validum Congdon (Erythea, vol. 7, p. 185. 1900) is unknown to me save from description, according to which it is very close to the above species, and may be, as Coulter and Rose suspect, merely a low altitude form; this conjecture is all the more probable since Congdon states that it is abundant about Wawona, Mariposa County, and descends along the streams to the foothills of the west slope.

2. **Selinum eryngiifolium** Greene, Pitt., vol. 2, p. 102. 1890.

Type locality.—"Near the Yosemite Valley, California."

Range.—Central Sierra Nevada and mountains of southern California.

Zone.—Canadian and Hudsonian.

Specimens examined.—Hermit Valley, Alpine County, Hansen 324, in part; east descent of Mono Pass, Mono County, Bolander 5089; Crescent Lake, Mariposa County, Congdon, August 13, 1895; Cloud's Rest, near the summit, Chesnut and Drew, July 12, 1889.

Coville and Funston 1475, collected on the headwaters of the Kaweah River, Tulare County, at 2,750 m., is referred here by Coulter and Rose (*l.c.*, p. 128).

7. EULOPHUS

Petiole broad and inflated	1. **E. simplex**
Petiole not enlarged	2. **E. Parishii**

1. **Eulophus simplex** Coult. and Rose, Contr. Nat. Herb., vol. 7, p. 112. 1900.

?*Carum Gairdneri* var. *latifolium* Gray, Proc. Am. Acad., vol. 7, p. 344. 1867.
Eulophus Pringlei var. *simplex* Coult. and Rose, Rev. N. Am. Umbell., p. 113. 1888.

Type locality.—"Sierra County, Cal."

Range.—Central Sierra Nevada.

Zone.—Canadian mainly, occurring also in the Arid Transition.

Specimens examined.—Near Carson City, Nevada, C. L. Anderson 100; Glen Alpine Tahoe, McGregor 24; same locality, Miss Lathrop, July 19, 1909; Ebbett's Pass, Alpine County, 7–8,000 feet (no collector given); Ostrander's meadows above Yosemite, Bolander 5017; Kern River Cañon, Tulare County, Culbertson (B 4503).

2. **Eulophus Parishii** Coult. and Rose, Rev. N. Am. Umbell., p. 112. 1888.

Pimpinella Parishii Coult. and Rose, Bot. Gaz., vol. 12, p. 157. 1887.

Type locality.—"Damp meadows, Bear Valley, San Bernardino Mts., California."

Range.—Sierra Nevada and mountains of southern California.

Zone.—Transition and Canadian.

Specimens examined.—Silver Lake, Amador County, 7,200 feet, E. Mulliken 152; Glen Alpine, Tahoe, Setchell and Dobie, July 6–21, 1901; Hockett's meadows, Tulare County, Culbertson (B 4450).

8. LIGUSTICUM

1. **Ligusticum apiifolium** (Nutt.) Gray, Proc. Am. Acad., vol. 7, p. 347. 1867.

L. apiifolium var. *minus* Gray, *in* Brewer and Wats., Bot. Calif., vol. 1, p. 264. 1876.
L. Grayi Coult. and Rose, Rev. N. Am. Umbell, p. 88. 1888.
Cynapium apiifolium Nutt., *in* T. and G., Fl., vol. 1, p. 641. 1840.

Type locality.—"Plains of Oregon, near the confluence of the Wahlmet."

Range.—British Columbia to California.

Zone.—Transition and Canadian, rising into the Hudsonian.

Specimens examined.—Mt. Rose, 10,000 feet, Kennedy 1151; about Marlette Lake, east of Lake Tahoe, 2,460 m., Baker 1490; Mt. Stanford (Castle Peak), Hooker and Gray in 1877; Silver Lake, Amador County, 8,000 feet, Hansen 901; same locality, 7,200 feet, E. Mulliken 149; Ebbett's Pass, Alpine County, 8,500 feet, Brewer 2082; Ostrander's, above Yosemite, 8,000 feet, Bolander 6341; Tioga Road, Yosemite, Congdon, August 29, 1895; Farewell Gap, Tulare County, R. Hopping 79; Alta meadows, Tulare County, Mrs. Brandegee, August 8, 1905.

9. PTERYXIA

1. **Pteryxia californica** Coult. and Rose, Contr. Nat. Herb., vol. 7, p. 172. 1900.

Type locality.—"Sisson, Siskiyou County, Cal."

Range.—Mountains of northern California (southern Oregon?) south in the Sierra Nevada to Tulare County.

Zone.—Transition and Canadian.

Specimens examined.—Sierra County, Lemmon 985; Cisco, Bolander in 1872; near Castle Peak, Heller 7070; Summit, Kellogg; Heather Lake, Tahoe, 7,800 feet, McGregor 183; Desolation Valley, Tahoe, 8,600 feet, dry sandy places, Smiley 97; Ebbett's Pass, Alpine County, dry hills, 9,000 feet, Brewer 1988; Tuolumne meadows, Yosemite, dry gravel, 8,600 feet, R. A. Ware 2681c; same locality, dry rocky ground, 8,500 feet, Smiley 706; Cloud's Rest, A. Gray in 1872; Crescent Lake, Mariposa County, Congdon, August 14 (without year); Collins' meadows, Fresno County, 7,500 feet, Hall and Chandler 541; Mineral King, Coville and Funston 1392; Alta meadows, Tulare County, Mrs. Brandegee, August 5, 1905; Farewell Gap, 10,600 feet, Purpus 5255; same locality, 10,400 feet, Hall and Babcock 5664.

The two specimens last cited present a form differing from the normal by broader leaf segments, which are abruptly acuminate and mucronate, and by reduced size of the whole plant, the two stations are both arctic-alpine and these slight changes of character probably represent the reaction of the species to the alpine habitat.

10. DRUDEOPHYTUM

Sterile rays of the umbel short (about ¼ inch long) and stout; fruit small .... 1. **D. Clementis**

Sterile rays of the umbel long (about ¾ inch long) and slender; fruit larger .... 2. **D. vestitum**

1. **Drudeophytum Clementis** Jones, Contr. W. Coast Bot., vol. 14, p. 33. 1912.

Type locality.—"On Mt. Whitney, Cal., alpine, also on Kearsarge Pass."

Range.—Southern Sierra Nevada.

Zone.—Canadian and above.

Specimens examined.—Gravelly plains near Mt. Whitney, 11–13,000 feet, Purpus 1479; mountains between Soda Creek and Little Kern River, 7–9,000 feet, Purpus 1769; Volcano meadows, Hall and Babcock 5469; Mt. Whitney, Culbertson (B 4353); near Whitney meadows (now called Volcano meadows), Tulare County, 2850 m., Coville and Funston 1628.

2. **Drudeophytum vestitum** (Wats.) Coult. and Rose, Contr. Nat. Herb., vol. 7, p. 83. 1900.

Deweya vestita Wats., Proc. Am. Acad., vol. 17, p. 374. 1882.
Arracacia vestita Wats., Proc. Am. Acad., vol. 22, p. 415. 1887.
Velaea vestita (Wats.) Coult. and Rose, Rev. N. Am. Umbell., p. 122. 1888.

Type locality.—"Summit of Mount Baldy, near San Bernardino, California."

Range.—Mountains of southern California and extending north into the southern Sierra Nevada.

Specimens examined.—Summit of Mt. Baldy, San Bernardino Mountains, Parish brothers 598; Mt. San Antonio, 9,000 feet, Abrams 1934; Long meadow, Tulare County, 2,400–2,700 m., Palmer 193.

Palmer's collection is not typical and perhaps future collections will show that true *D. vestitum* is restricted to the mountains south of our limits, and that *D. Clementis* is our single representative of the genus.

11. PODISTERA

1. **Podistera nevadensis** (Gray) Wats., Proc. Am. Acad., vol. 22, p. 475. 1887.

Cymopterus (*?*) *nevadensis* Gray, Proc. Am. Acad., vol. 6, p. 536. 1865.

Type locality.—"At and near the summit of Mount Dana," California.

Range.—Mt. Dana and vicinity.

Zone.—Arctic-alpine.

Specimens examined.—Summit of Mt. Dana, Brewer 1739, 2717; same locality, H. M. Evans, July, 1901; foot of Mt. Dana, Congdon, August 27, 1895; Mt. Dana, T. Labouchere, July, 1915; Mt. Dana, alpine zone, 11,750–13,000 feet, Hall and Babcock 3607; summit of Mt. Warren, Tuolumne County, Congdon, August 21, 1894.

12. AULOSPERMUM

1. **Aulospermum cinerarium** (Gray) Coult. and Rose, Contr. Nat. Herb., vol. 7, p. 196. 1900.

Cymopterus cinerarius Gray, Proc. Am. Acad., vol. 6, p. 535. 1866.

Type locality.—"In volcanic ashes, on dry hills in the high Sierra Nevada, at Sonora Pass, and above Lake Mono, alt. 9–10,000 feet."

Range.—East slope of the Sierra Nevada in the Yosemite region.

Zone.—Canadian.

Specimens examined.—Dry hill at Sonora Pass, 10,100 feet, Brewer 1899; top of volcanic hill, south of Mono Lake, 9,000 feet (Mono Craters), Brewer 1825.

44. ERICACEAE (Heath Family)

- Corolla none .... 1. **Allotropa**
- Corolla present.
  - Corolla polypetalous or nearly so.
    - Inflorescence corymbose.
      - Leaves toothed, green on both sides; stems trailing, scarcely woody .... 2. **Chimaphila**
      - Leaves entire, glaucous beneath; stems erect, woody .... 3. **Ledum**
    - Inflorescence racemose.
      - Ovary 1-celled; colorless saprophyte .... 4. **Pleuricospora**
      - Ovary 5-celled; green or greenish plants .... 5. **Pyrola**
  - Corolla gamopetalous.
    - Plants with green leaves, autotrophic.
      - Ovary inferior .... 6. **Vaccinium**
      - Ovary superior.
        - Fruit a drupe-like berry .... 7. **Arctostaphylos**
        - Fruit a capsule.
          - Dehiscence of capsule septicidal.
            - Stamens exserted from the corolla; leaves with persistent decurrent woody bases .... 8. **Phyllodoce**
            - Stamens included; leaves without persistent woody bases 9. **Kalmia**
          - Dehiscence of capsule loculicidal.
            - Leaves flat, larger (1.3–2.6 inches long), petioled .... 10. **Leucothoe**
            - Leaves carinate, smaller (¼ inch or less long), sessile .. 11. **Cassiope**
- Plants without green leaves, reddish saprophytes .... 12. **Sarcodes**

1. ALLOTROPA

1. **Allotropa virgata** T. and G., Pac. R.R. Rep., vol. 6, pt. 5, pp. 80, 81. 1857.

Type locality.—"Cascade Mountains of northern Oregon."

Range.—Sierra Nevada and Cascade Mountains. Coast Range of northern California and Oregon. Olympic Mountains.

Zone.—Transition and Canadian.

Specimens examined.—Sierra Valley, Lemmon in 1873; near Webber Lake, Kennedy and Doten 145; Lake Tahoe region, 9,000 feet, W. D. Bliss 1789; King's River region, 8–9,000 feet, R. W. Gibbs, August 20, 1898.

2. CHIMAPHILA

Leaves numerous and sharply toothed ....1. **C. umbellata**
Leaves fewer and merely serrulate ....2. **C. Menziesii**

1. **Chimaphila umbellata** (L.) Barton, Veg. Mat. Med. U. S., vol. 1, p. 17, t. 1. 1817.

Pyrola umbellata L., Sp. Pl., p. 396. 1753.
Chimaphila corymbosa Pursh, Fl., vol. 1, 300. 1814.
Chimaphila occidentalis Rydb., N. Am. Fl., vol. 29, pt. 1, p. 30. 1914.

Type locality.—"Habitat in Europae, Asiae et Americae septentrionalis sylvis."

Range.—Holarctic realm; in America south to Georgia along the Appalachians; in the west reaching into Mexico.

Zone.—Transition and Canadian, the latter rarely.

Specimens examined.—Trail over moraine south of Fallen Leaf Lake to Angora Lake, Tahoe, Miss Lathrop, July 23, 1909; Glen Alpine, Tahoe, 7,000 feet, McGregor 35.

According to Wooton and Standley[110] this species in New Mexico grows in "Deep woods, in the Canadian and Hudsonian zones."

2. **Chimaphila Menziesii** (R. Br.) Spreng., Syst., vol. 2, p. 317. 1825.

Pyrola Menziesii R. Br., *in* D. Don, Mem. Wern. Soc., vol. 5, p. 245. 1824.

Type locailty.—"Habitat in Americae ora boreali-occidentali."

Range.—British Columbia to California.

Zone.—Transition mainly, rising occasionally into the Canadian.

Specimens examined.—Moraine south of Fallen Leaf Lake, Tahoe, 7,200 feet, Smiley 21; Dougherty Meadow, Tulare County, in forest, Dudley 1444; Grant Park, Tulare County, Dudley 1211.

3. LEDUM

1. **Ledum glandulosum** Nutt., Trans. Am. Phil. Soc., vol. 8, p. 270. 1843.

Type locality.—"In the central chain of the Rocky Mountains on the sides of mountains which close up Thornburg's ravine."

Range.—British Columbia to California and Wyoming. Idaho and east Nevada.

Zone.—Canadian, rarely coming down along streams into the Transition.

Specimens examined.—Butterfly Valley, Plumas County, 3,800 feet, (Transition?), Hall 9274; Gold Lake, Sierra County, 6,400 feet, Hall and Babcock 4503; Hunter Creek, Washoe County, Nevada, 6,000 feet, Kennedy 1898; ridge below Lake Lucile, Tahoe, Dudley, June 26, 1900; Gilmore Lake, Tahoe, 8,300 feet, Abrams 4855; at water's edge, Lower Angora Lake, Tahoe, Miss Lathrop, July 21, 1909; same locality, 7,700 feet, Smiley 31; Castle Peak, by a small lake, 8,300 feet, Smiley 474; Carson Spur, Amador County, Hansen 794; Mt. Tallac, Dudley, June 9, 1893; Shuteye Pass, Sierra National Forest, 7,000 feet, Abrams 4940; above Donner Lake toward Donner Pass, Heller 7046; Mono Pass, Bolander; head of Tuolumne River, 9,000 feet, Brewer 1763; trail from Snow Creek to Lake Tenaya, Yosemite, by a small lake, 8,500 feet, Smiley 676; meadows near Black Mountain, Fresno County, 9,500 feet, Hall and Chandler 597; Nellie Lake, Fresno County, 8,700 feet, Smiley 599; South Lake, Bishop Creek, Inyo County, 10,000 feet, A. Davidson 2650; Southern Sierras, Brewer 2831; Mineral King, Tulare County, Coville and Funston 1556; Hockett's meadows, Tulare County, Culbertson (B 4426); Needles Ridge, Lloyd Mountain, Tulare County, 8,000 feet, Dudley 856; Alta Peak trail, Tulare County, Dudley 1253.

This is the most characteristic shrub growing about lake borders in the Canadian zone and frequently the smaller lakes will be found nearly surrounded by a growth of Ledum.

4. PLEURICOSPORA

1. **Pleuricospora fimbriolata** Gray, Proc. Am. Acad., vol. 7, p. 369. 1868.

Type locality.—"In or near the Mariposa *Sequoia gigantea* Grove," California.

Range.—California to Washington.

Zone.—Transition and Canadian.

Specimens examined.—Plumas County, Mrs. Austin in 1877; Big Trees, Mariposa County, Bolander 4997; near Tar Gap, Tulare County, 2,770 m., in an *Abies magnifica* forest, Hall, 5587.

5. PYROLA

Style straight; stigmas with deflexed papillae.
  Style longer than the petals .... 1. **P. secunda**
  Style shorter than the petals .... 2. **P. minor**
Style curving upward; stigmas with erect or united papillae.
  Leaves elliptic to suborbicular, dark green above .... 3. **P. asarifolia**
  Leaves ovate to acute, white veined .... 4. **P. picta**
  Leaves spatulate, upper surface pale .... **P. picta** var. **integra**

1. **Pyrola secunda** L., Sp. Pl., p. 396. 1753.

Ramischia secunda (L.) Garcke, Fl. Deutsch., ed. 4, p. 222. 1858.

Type locality.—"Habitat in Europae borealis sylvis."

Range.—Holarctic realm; in America from the subarctic regions south to Maryland, Michigan, South Dakota, New Mexico, and California.

Zone.—Canadian.

Specimens examined.—Plumas County, Lemmon in 1875; high mountain near Donner Pass, Torrey 283; Carson Spur, Alpine County, 8,500 feet, Hansen 711; slope above Gilmore Lake, Tahoe, 8,400 feet, Smiley 374; between Lake Tahoe and Lake Lucile, 7–8,000 feet, Miss K. A. Chandler, September, 1901; Snow Valley, Ormsby County, Nevada, 2,460–2,615 m., Baker 1485; Half-Moon Lake, Tahoe, 8,200 feet, Smiley 423; Glen Alpine, Tahoe, McGregor 22; Tuolumne Cañon, Yosemite, Chesnut and Drew, July 25, 1889; Panther Gap, Tulare County, Dudley 1250.

2. **Pyrola minor** L., Sp. Pl., p. 396. 1753.

Erxlebenia minor (L.) Rydb., N. Am. Fl., vol. 29, pt. 1, p. 28. 1914.

Type locality.—"Habitat in Europa frigidiore."

Range.—Holarctic realm; in America from the subarctic regions south to Maritime Provinces of Canada, northern New England, Michigan, Minnesota, Colorado, and California (?).

Zone.—Canadian.

No collections from the Sierra referable to this species have been seen by me and it is here included only because it is reported[89] to have been collected in the high mountains of Tulare County (near East Lake, *Miss K. E. Wilson*) and is also said[101] to be growing in Little Yosemite Valley.

3. **Pyrola asarifolia** var. **incarnata** Fernald, Rhodora, vol. 6, p. 178. 1904.

P. rotundifolia var. *bracteata* Gray, *in* Brewer and Wats., Bot. Calif., vol. 1, p. 460. 1876.
P. rotundifolia var. *incarnata* DC., Prodr., vol. 7, p. 773. 1839.
P. incarnata Fisch., *in* DC., Prodr., *l.c.*, as synonym.
P. uliginosa T. and G., *in* Torr., Fl. N. Y., vol. 1, p. 453. 1843.

Type locality.—"In Dahuria."

Range.—Gulf of St. Lawrence to Alaska, south to northern New England and New York, Great Lakes, northern Rocky Mountains, and California.

Zone.—Transition and lower Canadian.

Specimens examined.—Near Fallen Leaf Lake, Tahoe, Miss Lathrop, July 12, 1909; near Glen Alpine, Tahoe, 6,700 feet, Smiley 275; Glen Alpine Creek, 6,400 feet, Hall 8800; Lucile trail, Tahoe, Miss K. A. Chandler, September 8, 1901; near Whitney Creek, Tulare County, 8–9,000 feet, Purpus 1895.

4. **Pyrola picta** Smith, *in* Rees, Cycl., vol. 29, no. 8. 1814.

Type locality.—"Found on the west coast of North America."

Range.—British Columbia to Montana, south to California and New Mexico.

Zone.—Transition and Canadian.

Specimens examined.—Carson Spur, Alpine County, 8,500 feet, Hansen 712; Glen Alpine, Tahoe, 7,000 feet, McGregor 36; trail over moraine to Angora Lakes, Tahoe, 7,100 feet, Smiley 30; near Lake of the Woods, Tahoe, Dudley, September 1, 1894; Nevada County, 7,000 feet, A. M. Carpenter, August-September 1893; about Marlette Lake, east of Lake Tahoe, 2,460 m., Baker 1481; east slope of Rubicon Peak, Tahoe, 7,300 feet, Smiley 400.

4a. **Pyrola picta** var. **integra** (Gray) Piper, Contr. Nat. Herb., vol. 11, p. 434. 1906.

P. dentata var. *integra* Gray, *in* Cooper, Pac. R.R. Rep. vol. 12, pt. 2, p. 54. 1860.

P. pallida Greene, Pitt., vol. 4, p. 39. 1899.

Type locality.—"On high wooded hills, east of Mount Adams."

Range.—Pacific Coast from British Columbia to King's River region, California, and east to Montana.

Zone.—Transition and Canadian.

Specimens examined.—Angora Lake trail, Tahoe, Miss Lathrop, July 21, 1909; Glen Alpine, Tahoe, 6,800 feet, McGregor 130; near

Angora Lake, Tahoe, 7,300 feet, Hall and Chandler 4654; Cascade Lake, Tahoe, C. J. Fox Jr., July, 1895; Cascade Mountains, Tahoe, Setchell and Dobie, July 6–21, 1901; Redwood meadow, Mineral King, Tulare County, Hall and Babcock 5380.

Pyrola aphylla Smith (*in* Rees, Cycl., vol. 29, no. 7. 1814), a common Transition species, rarely is found along our lower borders (Aspen Valley, Yosemite, 6,400 feet, Smiley 909.

Moneses uniflora (L.) Gray, a typical member of the glacial flora, and in North America ranging from the subarctic region south to the Middle Atlantic States, Minnesota, New Mexico, and on the west coast in typical form to Oregon, is present on Mt. Shasta in the var. *reticulata* (Nutt.) S. F. Blake (Rhodora, vol. 17, p. 29. 1915), but is not known from the Sierra Nevada.

6. VACCINIUM

Corolla usually 4–lobed; leaves lanceolate ....1. **V. occidentale**
Corolla usually 5–lobed; leaves obovate, cuneate ....2. **V. caespitosum**

1. **Vaccinium occidentale** Gray, *in* Brewer and Wats., Bot. Calif. vol. 1, p. 451. 1876.

Type locality.—"Sierra Nevada at 6,000 or 7,000 feet, from Mariposa to Sierra Co."

Range.—Washington to Wyoming and southward to California and Utah.

Zone.—Canadian.

Specimens examined.—Plumas County, Mrs. Austin; Sierra Valley, Lemmon; Mt. Rose, 9,650 feet, Heller 9919; near Fallen Leaf Lake, Tahoe, 7,000 feet, Abrams 4805; Glen Alpine, Tahoe, 6,600 feet, McGregor 213; Mono trail, Yosemite, Bolander 6299; Tuolumne meadows, Yosemite, Miss K. D. Jones 539; Long Lake, Plumas County, 6,700 feet, Hall 9326; Shuteye Pass, Sierra National Forest, Abrams 4944; Upper Green Meadow, Tulare County, Dudley 2253; Moraine Lake, Tulare County, 9,000 feet, Dudley 2180; Tuolumne meadows, prostrate on exposed ledges by the river, 8,600 feet, R. A. Ware 2663c.

2. **Vaccinium caespitosum** Michx., Fl., vol. 1, p. 234. 1803.

V. caespitosum var. *cuneifolium* Nutt., *in* Gray, Syn. Fl., vol. 2, pt. 1, p. 24. 1878.
V. caespitosum var. *arbuscula* Gray, Syn. Fl., vol. 2, pt. 1, p. 24. 1878.

Type locality.—"In borealibus Americae, praesertim circa sinum Hudsonis."

Range.—Subarctic America from Alaska to Labrador, south to New England, Great Lakes, Colorado, and California.

Zone.—Canadian to above timber line.

Specimens examined.—Plumas County, Mrs. Austin in 1876; Long Lake, Plumas County, 6,700 feet, Hall 9327; Pyramid Peak, 9,500 feet, W. S. Atkinson in 1900; Heather Lake, Tahoe, 7,800 feet, McGregor 142; Desolation Valley, Tahoe, forming mats, 8,700 feet, Smiley 79; Castle Peak, 8,900 feet, Smiley 485; Suzy Lake, Tahoe, Abrams 4860; Mt. Dana, 12,000 feet, R. A. Ware 2617c; same locality, H. M. Evans, July, 1901; Crescent Lake, Mariposa County, Congdon, August 9, 1890; near Mineral King, Tulare County, above timber line, Coville and Funston 1552; Eagle Lake, alpine zone, Tulare County, 10,500 feet, Hall and Babcock 9327; Arroyo-Kern Divide, Tulare County, Dudley 2432.

This is the common blueberry of the high mountains, often forming extensive dwarf thickets in the wet meadows. The abundant collections now available for comparison show that the varieties distinguished in the Synoptical Flora are impossible of maintenance, ovate and obovate leaves occurring upon the same plants.

7. ARCTOSTAPHYLOS

1. **Arctostaphylos nevadensis** Gray, Syn. Fl., vol. 2, pt. 1, p. 27. 1878.

Type locality.—"Sierra Nevada, California, common at 8–10,000 feet."

Range.—Pacific Coast in the Cascades and Sierra Nevada from Washington to the King's River region. Also in the North Coast Ranges (Lake County).

Zone.—Canadian and Hudsonian.

Specimens examined.—Donner Lake, Dudley, June, 1900; above Donner Lake toward Donner Pass, Heller 7041; Pedlar, Amador County, 6,500 feet, Hansen 1924; slope above Heather Lake, Tahoe, 8,600 feet, Smiley 280; Mt. Tallac, Tahoe, 9,000 feet, Abrams 4837; Glen Alpine, Tahoe, W. W. Price, July 12, 1898; Bald Mountain, Dinkey Creek, Fresno County, 9,000 feet, Hall and Chandler 414.

Arctostaphylos patula Greene (Pitt., vol. 2, p. 171. 1891), distinguished from the above species by the larger leaves being very obtuse or almost orbicular as contrasted with the sharply pointed leaves of *A. nevadensis,* is primarily of the Transition zone, but not rarely met with along our lower borders (Shuteye Mountain, Madera County, 7,500 feet, Smiley 556).

8. PHYLLODOCE

1. **Phyllodoce Breweri** (Gray) Heller, Muhl., vol. 1, p. 1. 1900.

Bryanthus Breweri Gray, Proc. Am. Acad., vol. 7, p. 367. 1867.

Type locality.—"High Sierras of California, alt. 10,000 feet; on Wood's Peak Eldorado Co., *Prof. Brewer;* near Donner's Pass, *Prof. Torrey.*"

Range.—Mountains of northern California through the Sierra Nevada to Mt. San Gorgonio, San Bernardino Mountains, southern California.

Zone.—Hudsonian, less often in the Canadian; rarely as an alpine dwarf.

Specimens examined.—About Summit Station, Heller 6979; high mountain near Donner Pass, Torrey 287; Half-Moon Lake, Tahoe, McGregor 86; Grass Lake, Tahoe, Miss Lathrop, July 19, 1909; shores of Heather Lake, Tahoe, 8,100 feet, Smiley 175; Carson Spur, Amador County, 8,000 feet, Hansen 796; near Lake Lucile, Tahoe, Setchell and Dobie, July 6–21, 1901; Fallen Leaf trail to Mt. Tallac, 8,000 feet, Abrams 4820; Wood's Peak, Eldorado County, Brewer 2123 at 10,000 feet; Mt. Hoffman, Yosemite, 10,000 feet, Brewer 1676; high Sierras along streamlets, 10,000 feet, Bolander 6300; Dog Lake, Tuolumne meadows, 9,300 feet, Smiley 840; Cloud's Rest, 9,900 feet, Smiley 518; Mt. Goddard, 11,100 feet, Hall and Chandler 699; Lambert's Dome, Yosemite, 9,400 feet, R. A. Ware 2648c; Cloud's Rest, 10,000 feet, A. Gray in 1872; Hockett's meadow, Tulare County, Culbertson (B 4499); rocky slopes near Little Kern River, 9,500–11,000 feet, Purpus 5162; Mt. Whitney, Culbertson (B 4354); base of Mt. Whitney, 12,000 feet, Rothrock 401; Lake meadows, Kaweah Peaks, Tulare County, 12,000 feet, Dudley 2125; near Alta Peak, Tulare County, Dudley 1525.

9. KALMIA

1. **Kalmia polifolia** Wang. var. **microphylla** Rehder, *in* Bailey, Cycl. Hort., vol. 2, p. 854. 1900.

K. glauca var. *microphylla* Hook., Fl. Bor. Am., vol. 2, p. 41. 1834.
K. microphylla Heller, Bull. Torr. Bot. Club, vol. 25, p. 581. 1898.

Type locality.—"Swamps in the Rocky Mountains."

Range.—Alaska and Yukon south to California and Colorado.

Zone.—Hudsonian.

Specimens examined.—Long Lake, Plumas County, 6,700 feet, Hall 9325; Webber Peak, Lemmon; Pyramid Peak, 9,000 feet, W. S. Atkinson in 1900; Suzy Lake, Tahoe, 7,800 feet, Abrams 4865; Suzy Lake Basin, 7,800 feet, Smiley 156; Lake of the Woods, Tahoe, 8,200 feet, Smiley 72; Half-Moon Lake, Tahoe, 7,760 feet, McGregor 83; Lucile Crest, Tahoe, 8,200 feet, Hall and Chandler 4661; Tuolumne meadows, Yosemite, 8,600 feet, H. M. Evans, July, 1901; Mt. Dana, 11–12,000 feet, Brewer 1747; Cathedral Peak, Yosemite, west side, 9,000 feet, Smiley 873; Elizabeth Lake meadow, Yosemite, 9,800 feet, Smiley 802; Kaiser Crest, Fresno County, 9,000 feet, Smiley 620; Upper Green meadows, Tulare County, 10,000 feet, Dudley 2252; woods west of Hockett's meadows, Tulare County, 9,000 feet, Dudley 1916; Mountain Lake shores, Tulare County, 10,000 feet, Dudley 946; slope of Black Peak, Kaweah Peaks, Tulare County, 12,000 feet, Dudley 2124; White Chief Mine, near Mineral King, alpine zone, Hall and Babcock 5651.

10. LEUCOTHOE

1. **Leucothoe Davisiae** Torr., *in* Gray, Proc. Am. Acad., vol. 7, p. 400. 1867.

Leucothoe Cusickii M. E. Jones, Contr. W. Coast Bot., vol. 11, p. 1. 1903.
Oreocallis Davisiae (Torr.) Small, N. Am. Fl., vol. 29, pt. 1, p. 58. 1914.

Type locality.—"Nevada Co., near Eureka, California."

Range.—Siskiyou Mountains and North Coast Ranges, and in the Sierra Nevada south to Fresno County.

Zone.—Transition and Canadian.

Specimens examined.—Plumas County, Mrs. Austin in 1876; Frog Lake on Mt. Stanford (Castle Peak), C. F. Sonne, July, 1887; Castle Peak, 8,300 feet, Smiley 475; vicinity of Sequoia and Hazel Green, 6,000 feet, Hall and Babcock 3404; Signal Peak, Mariposa County, Congdon, September 16, 1883; Shuteye Mountain, Madera County, 7,600 feet, Smiley 558; Shuteye Pass, Sierra National Forest, 7,000 feet, Abrams 4939; between Northfork and Forest Headquarters, Madera County, Mrs. Brandegee, July, 1914.

11. CASSIOPE

1. **Cassiope Mertensiana** (Bong.) G. Don, Hist. Dichl. Pl., vol. 3, p. 829. 1834.

Andromeda Mertensiana Bong., Mem. Acad. St. Petersb., VI, vol. 2, p. 152. 1832.
Andromeda cupressina Hook., Fl. Bor. Am., vol. 2, p. 38. 1834.
Cassiope Mertensiana gracilis Piper, Smithson. Misc. Coll., vol. 50, p. 195. 1907.
Cassiope Mertensiana ciliolata Piper, *l.c.*, p. 196.
Cassiope Mertensiana californica Piper, *l.c.*, p. 196.

Type locality.—Sitka.

Range.—Alaska to the southern Sierra Nevada along the coast mountains, and in the Selkirks and northern Rockies to Montana.

Zone.—Hudsonian.

Specimens examined.—Ridge above Donner Pass, Heller 7131; Castle Peak, 8,400 feet, Smiley 477; Heather Lake and Desolation Valley, Tahoe, Dudley, June, 1900; Suzy Lake, Tahoe, 7,800 feet, Abrams 4863; Desolation Valley, Tahoe, 8,600 feet, Smiley 82; rocky slope above Coldstream, Placer County, 8,000 feet, C. F. Sonne, August, 1896; Silver Lake, Amador County, 8,500 feet, G. Schrader, July, 1910; Mt. Lyell, 11,000 feet, Hall and Babcock 3578; near Tuolumne meadows, 8,600 feet, H. M. Evans, July, 1901; Dana Creek, Yosemite, 9,600 feet, Smiley 847; Dog Lake, Tuolumne meadows, 9,240 feet, Smiley 841; Mt. Dana, Bolander 6019; foot of Mt. Dana, Congdon, August 10, 1898; east base of Mt. Brewer, 10,000 feet, Brewer 2805.

The range as given, extending to the southern Sierra, is based upon the last station cited; this may be incorrect since this species is otherwise unknown south of the Yosemite district. It is not improbable that there has been an error made in writing the name of the station.

12. SARCODES

1. **Sarcodes sanguinea** Torr., Pl. Frem., p. 18. 1853.

Type locality.—''Valley of the Sacramento; the precise locality not recorded, but probably on the Yuba River.''

Range.—California and southern Oregon.

Zone.—Transition and Canadian.

Specimens examined.—Silver Lake, Amador County, 7,200 feet, E. Mulliken 117; Carson Spur, Alpine County, 8,500 feet, Hansen 245; Grass Lake, Tahoe, Miss Lathrop, July 19, 1909; Cloud's Rest trail, Yosemite, 7,900 feet, Smiley 506.

45. PRIMULACEAE (Primrose Family)

Corolla lobes erect or spreading; stamens included.
  Corolla small and white, contracted at the throat; dwarf annual ..1. **Androsace**
  Corolla larger (½–¾ inch long), red-purple, funnel form; perennial 2. **Primula**
Corolla lobes reflexed; stamens exserted ....3. **Dodecatheon**

1. ANDROSACE

1. **Androsace septentrionalis** var. **subulifera** Gray, Syn. Fl., vol. 2, pt. 1, p. 60. 1878.

Type locality.—"Rocky Mountains near Boulder City, Colorado, *H. G. French.* San Bernardino County, California, *Parry and Lemmon.*"

Range.—Rocky Mountains to the Pacific Coast.

Specimens examined.—Mt. Dana, in saddle, 11,600 feet, W. L. Jepson 3306.

Through the kindness of Dr. Jepson, I was able to examine this interesting collection, the first of the species (and also of the genus) so far made within our limits. It had before been collected in California in the San Bernardino Mountains, and in the White Mountains of Inyo County (*Shockley* 452 at 13,000 feet).

2. PRIMULA

1. **Primula suffrutescens** Gray, Proc. Am. Acad., vol. 7, p. 37. 1867.

Type locality.—"Sierra Nevada, on Silver Mountain, alt. 10,500 feet, near the snow. *Brewer.*"

Range.—Sierra Nevada.

Zone.—Arctic-alpine.

Specimens examined.—Plumas County, Mrs. Austin in 1878; Castle Peak near the highest point, Heller 7096; same locality, Pringle, September 23, 1882; Cloud's Rest, 10,000 feet, A. Gray in 1872; Mt. Dana, H. M. Evans, July, 1901; Mt. Gibbs, Yosemite, 12,200 feet, Smiley 781; Denel's Peak, Upper Kern River, 10,500–12,800 feet, Hall and Babcock 5509; Mt. Whitney, Culbertson (B 4524); Kaiser Peak, Fresno County, 10,200 feet, Smiley 645; Whitney meadows, above timber line on mountains north of meadows, Coville and Funston 1663; Sawtooth Peak, Tulare County, 12,000 feet, Hall and Babcock 5677; Black Peak, Kaweah Peaks, Tulare County, 12,000 feet, Dudley 2128; near top of Alta Peak, Tulare County, 11,000 feet, Dudley 1538; Fisherman's Peak (Old Mt. Whitney), 13,000 feet, Cowles 419; rocks on slope of Mt. Kaweah, Tulare County, 12,000 feet, Dudley 2106.

3. DODECATHEON

Inflorescence and base of the style glandular-pubescent; usually 10–24 inches high, with leaves oblanceolate, 2–15 inches long, ¾–2.5 inches broad, entire (rarely dentate); capsule included or equalling the sepals ....1. **D. Jeffreyi**

Infloresence and base of the style not glandular-pubescent; capsules exserted.

  Leaves narrowly lanceolate, acute, 2–6 inches long, ¼–⅝ inch broad and very smooth ....2. **D. alpinum**

  Leaves oblong, obtuse, somewhat broader than in No. 2, but about as long ....3. **D. tetrandrum**

1. **Dodecatheon Jeffreyi** Van Houte, Fl. des serres, vol. 16, p. 90. 1865–67.

D. crenatum Greene, Erythea, vol. 2, p. 74. 1890.
D. viviparum Greene, Erythea, vol. 3, p. 38. 1895.

Type locality.—"Montagnes-Rocheuses," but the description drawn from a cultivated strain.

Range.—British Columbia through Idaho and Washington to southern Sierra Nevada. Mountains of southern California. White Mountains, Inyo County.

Zone.—Transition and sporadically above.

Specimens examined.—Yosemite, J. M. Hutchings; Peregoy's, above Yosemite, A. Gray in 1872; Camp Whiskers on Shuteye Pass, 6,000 feet, Abrams 4933; Mt. Raymond, Madera County, meadow at 7,800 feet, Smiley 531; Bonita meadow, Tulare County, 8,000 feet, Hall and Babcock 5172; south side of Farewell Gap, Tulare County, 9,300 feet, Hall and Babcock 5398.

1a. **Dodecatheon Jeffreyi** var. **redolens** Hall, Bot. Gaz., vol. 31, p. 392. 1901.

Type locality.—"Along the lakes at the base of Mt. Goddard, 3,400 m."

Range.—Central and southern Sierra Nevada.

Zone.—Hudsonian.

Specimens examined.—Foot of Mt. Goddard, alpine zone, Hall and Chandler 676; Mt. Whitney, Culbertson (B 4531); mountains along Little Kern River, wet places, 11–12,000 feet, Purpus 5246; Mt. Whitney, above Langley's Camp, 12,000 feet, Hall and Babcock 5543.

This variety is technically distinguished by the corolla lobes not being closely reflexed and hence concealing the bases of the anthers, which in the typical form are exposed.

1b. **Dodecatheon Jeffreyi** f. **pygmaeum** Hall, Univ. Calif. Publ. Bot., vol. 4, p. 203. 1912.

Type locality.—"Wet soil on Pyramid Peak, Eldorado County, California, at an altitude of 2,740 m."

Range.—Sierra Nevada.

Zone.—Canadian and Hudsonian.

Specimens examined.—Pyramid Peak, 9,000 feet, Hall and Chandler 4739; same locality, east side at 9,800 feet, Smiley 86; above Heather Lake, Tahoe, Setchell and Dobie, July 6–21, 1901; Suzy Lake, Tahoe, 7,950 feet, McGregor 47 in part; Mt. Gibbs, Yosemite, at timber line, 10,400 feet, Smiley 768; Elizabeth Lake meadow, Yosemite, 9,800 feet, Smiley 793; Snow Flat, Yosemite, 8,700 feet, Hall and Babcock 3486; mountains near Little Kern River, Tulare County, 11–12,000, Purpus 5239 in part.

This is simply the dwarfed alpine state of the species usually seen near or above timber line but the same nanism may be developed at much lower altitudes when the plant is subjected to difficult life conditions.

2. **Dodecatheon alpinum** Greene, Erythea, vol. 3, p. 39. 1895.

Type locality.—"Common along boggy margins of sub-alpine lakes in the Sierra Nevada of California, more especially from Donner Lake southward."

Range.—Northeast Oregon (Wallowa Mountains) southward through the mountains of northern California, through the Sierra to the mountains of southern California.

Zone.—Canadian.

Specimens examined.—Independence Lake, Sierra County, C. F. Sonne, June 26, 1893; Carson Spur, 8,500 feet, Hansen 722; bogs near Donner Lake, Brandegee, July, 1889; Mt. Tallac, W. C. Blasdale, July, 1897; Dog Lake marsh, Tuolumne meadows, 9,240 feet, Smiley 842; meadows near Black Mountain, Fresno County, 10,500 feet, Hall and Chandler 620; Tuolumne meadows, Yosemite, 8,600 feet, R. A. Ware 2671c; Kaweah meadows, Tulare County, 9,300 feet, Purpus 5183.

2a. **Dodecatheon alpinum** f. **nanum** Hall, Univ. Calif. Publ. Bot., vol. 4, p. 205. 1912.

Type locality.—"Mount Dana, Mariposa County, California, at 3350 m. alt."

Range.—Not known from beyond the Sierra Nevada, but probably co-extensive with the range of the species, of which this is the alpine dwarfed form.

Zone.—Arctic-alpine, but occasionally in the Hudsonian.

Specimens examined.—Castle Peak, 8,800 feet, Smiley 483; Lake of the Woods, on meadow, 8,200 feet, Smiley 69; Mono Pass, wet places at 10,765 feet, Brewer 1717; Mt. Dana, 11–12,000 feet, Brewer 1742; same locality, 11,000 feet, Hall and Babcock 3618 (type); Mt. Silliman, Tulare County, Mrs. Brandegee.

3. **Dodecatheon tetrandrum** Suksdorf, *in* Greene, Erythea, vol. 3, p. 40. 1895.

Type locality.—Not definitely given.

Range.—Washington through the mountains of Oregon to the Siskiyous and southward in the Sierra to Lake Tahoe. Warner Mountains of Modoc County.

Zone.—Canadian.

Specimen examined.—About Marlette Lake, east of Lake Tahoe, Nevada, Hall and Chandler 4591.

46. GENTIANACEAE (Gentian Family)

Leaves trifoliate; plant aquatic .... 1. **Menyanthes**
Leaves simple, entire; plants terrestrial.
  Corolla not glanduliferous at base, funnel-form or campanulate; leaves opposite .... 2. **Gentiana**
  Corolla with a large fringed pit or gland at base of each lobe or a pair of glands; corolla rotate.
    Style very short or none; flowers 5-merous .... 3. Sweertia
    Style evident (1/8 inch or longer); flowers 4-merous .... 4. **Frasera**

1. MENYANTHES

1. **Menyanthes trifoliata** L., Sp. Pl., p. 145. 1753.

Type locality.—"Habitat in Europae paludibus."

Range.—Holarctic realm; in America south from the subarctic region (Labrador-Alaska) to the Middle Atlantic States, Great Lakes, Iowa, Colorado, and California.

Zone.—Transition and Canadian.

Specimens examined.—Mt. Stanford (Castle Peak), meadow along the trail, C. F. Sonne, July 19, 1885; Lily Lake, Tahoe, 6,600 feet, Smiley 332; meadows near Black Mountain, Fresno County, in ponds, 9,500 feet, Hall and Chandler 732.

2. GENTIANA

Perennials with calyx surrounded by an involucre of leaf-like bracts.
  Flowers solitary and terminal on the short (1–5 inch) stem; corolla lobes acute ....1. **G. Newberryi**
  Flowers 1–several at the summit of the longer (4–18 inch) stem; corolla lobes rounded ....2. **G. calycosa**
Annuals of slender habit, with the calyx naked.
  Plant very leafy to the top and many flowered; flowers ½ inch long ....3. **G. amarella**
  Plants with but few leaves (2 or 3 pairs); flowers terminal, solitary, 1 inch long.
    Stems branching at base and leafy below, with the upper and longer part scapose; corolla lobes entire or rarely erose-denticulate about the summit; seeds scabrid with minute scales ....4. **G. holopetala**
    Stems always simple and leafy to the middle or above; corolla lobes dentate at summit; seeds smooth ....5. **G. simplex**

1. **Gentiana Newberryi** Gray, Proc. Am. Acad., vol. 11, p. 84. 1876.

Type locality.—"Oregon and California, in the Sierra Nevada, from Crater Pass (*Newberry*) to Mariposa County, *Bolander.*"

Range.—Mt. Whitney region of the Sierra Nevada northward to the mountains of Siskiyou County and southern Oregon. White Mountains of Inyo County.

Zone.—Canadian and Hudsonian.

Specimens examined.—Plumas County, Mrs. Austin in 1876; Webber Lake, Lemmon; Silver Lake, Amador County, 8,000 feet, Hansen 707; Ralston Peak, Tahoe, 8,100 feet, Smiley 414; near Glacier Point, Yosemite, Congdon, August 4, 1898; Yosemite trail between Clark's and Westfall's meadows, Bolander 6360; Lyell Fork, Tuolumne River, 9,000 feet, E. B. Babcock, August, 1915; near Glacier Point, Miss Jane White, September, 1902; Eagle Peak meadows, Yosemite, 8,000 feet, Smiley 493; Dana Fork meadows, Yosemite, 10,100 feet, Smiley 860; Hockett's meadows, Tulare County, Dudley 1011; Crabtree meadows, Tulare County, 10,330 feet, H. M. and G. R. Hall 8442; Kaweah meadows, Tulare County, 9–10,000 feet, Purpus 5198.

2. **Gentiana calycosa** Griseb., *in* Hook., Fl. Bor. Am., vol. 2, p. 58, t. 146. 1838.

G. calycosa var. *stricta* Griseb., *l.c.*
G. Gormani Howell, Fl. N.W. Am., vol. 1, p. 446. 1901.
Pneumonanthe calycosa Greene, Leaflets, vol. 1, p. 71. 1904.

Type locality.—"At Mount Rainier, on the northwest coast."

Range.—British Columbia to California and Wyoming. Colorado?

Zone.—Hudsonian and Arctic-alpine.

Specimens examined.—Plumas County, 6,500 feet, Mrs. R. M. Austin in 1878; Sierra Nevada above Summit Valley, 8,000 feet, Pringle, September 21, 1882; Mt. Tallac, Tahoe, 9,500 feet, Smiley 366; Glen Alpine, Tahoe, 7,000 feet, McGregor 168; Carson Spur, Alpine County, 8,500 feet, Hansen 709; mountains west of Lake Tahoe, Brandegee, September, 1883; Mineral King, Tulare County, Dudley 2613; top of Monarch Creek trail, Tulare County, 11–12,000 feet, Dudley 1594; meadows near Farewell Gap, Tulare County, 10–11,000 feet, Purpus 5228; Little Kern River, 8,500 feet, Culbertson (B 4398); Squaw Valley, Forest Hill Pass, 8,800 feet, Brewer 2664.

3. **Gentiana amarella** L. var. **acuta** (Michx.), Herder, Acta Hort. Petrop., vol. 1, p. 428. 1872.

G. acuta Michx., Fl., vol. 1, p. 177. 1803.
G. plebeja Cham., *in* Bunge, Conspect. Gen. Gent., p. 54. 1824.*

Type locality.—"In altis montibus Carolinae et in Canada, prope Tadoussack."

Range.—Subarctic America south to northern New England, Minnesota, North Dakota, New Mexico, and California.

Zone.—Transition and Canadian.

Specimens examined.—Plumas County, 6,500 feet, Mrs. Austin in 1878; Sierra County, Lemmon 746; Tuolumne River, Bolander in 1866; vicinity of Mineral King, 7,800 feet, Hall and Babcock 5646; Soda Springs, southern Sierras, Brewer 2848; Whitney meadows, Tulare County, Purpus 1632.

Wettstein† proposes to maintain *G. acuta* Michx. separate from the Old World species and to consider *G. plebeja* Cham. as a subspecies with a range confined to the Cordilleran section of North America and westward; as an example of this subspecies he cites *Bolander* 5045 from the Tuolumne River. I have not seen a sheet with this *number* upon it, but assume that the collection by Bolander from the Tuolumne River cited above is of the same collection and examination fails to show any convincing reason for contrasting it with the other specimens of var. *acuta* from the Sierra or of the north and east.

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* Dr. Greene, in Leaflets vol. 1, characterizes the following synonyms: *anisosepala* (p. 53); *Macounii* (p. 54); *scopulorum* (p. 55); *Californica* (p. 54), all in 1904.

† Die nordamerikanischen Arten d. Gattung *Gentiana*, sect. Endotr.; Oestr. Bot. Zeitschrift, vol. 50, p. 195. 1900.

4. **Gentiana holopetala** (Gray) Holm, Ottawa Nat., vol. 15, p. 110. 1901.

G. serrata Gunner, var. *holopetala* Gray, *in* Brewer and Wats., Bot. Calif., vol. 1, p. 481. 1876.

Type locality.—"Wet ground, in the higher regions of the Sierra Nevada: Soda Springs of the Tuolumne, at 8,600 feet (a pygmy form, only 2 to 5 inches high, with leaves merely 4 or 5 lines long and crowded towards the base), to Mariposa Co. above the Yosemite (much larger, a span high or more, *Bolander.*"

Range.—Sierra Nevada from the Yosemite region southward to Tulare County.

Zone.—Canadian mainly.

Specimens examined.—Soda springs of the Tuolumne, 8,600 feet, Bolander 2847; Ostrander's, above Yosemite, 7–8,000 feet, Bolander 6359; trail to Cloud's Rest, 8,000 feet, Smiley 505; Tuolumne meadows near the river (tip of petals erose), 8,500 feet, Smiley 832; South Fork of the San Joaquin, 7,650 feet, Hall and Chandler 630; Nellie Lake, Fresno County, 8,800 feet, Smiley 612; meadow on Shuteye Mountain, Madera County, 7,800 feet, Smiley 555; Natural Bridge meadow, Tulare County, 8,000 feet, Culbertson (B 4260); Funston's meadows, Tulare County, 9,000 feet, Dudley 2181; near Farewell Gap, Dudley 2599, 1141; South Fork of Kern River, 9,800 feet, Rothrock 381, 313 at 10,000 feet.

The petals of this species are not always truly entire, but they are never deeply incised as in *G. elegans* A. Nels. of the Rockies of Wyoming and Colorado.

5. **Gentiana simplex** Gray, Pac. R.R. Rep., vol. 6, p. 87, t. 16. 1857.

Type localtiy.—"Upper Klamath Lake," California.

Range.—Mountains of eastern Oregon south through the Mt. Shasta region and the Sierra Nevada to the mountains of southern California. Southern Idaho.

Zone.—Canadian.

Specimens examined.—Summit of Mt. Dyer, Plumas County, Mrs. Austin in 1880; Sierra County, Lemmon 727; Summit Valley, Sierra County, 7,000 feet, E. L. Greene 385; Carson Spur, Alpine County, 8,500 feet, Hansen 708; Angora Lakes, Tahoe, 7,000 feet, McGregor 210; Squaw Valley trail, Placer County, 8,000 feet, Brewer 2153; Converse Basin, Fresno County, Dudley, August 18, 1904; Mt. Raymond, Madera County, 7,800 feet, Smiley 530; Nellie Lake meadow, Fresno County, 8,500 feet, Smiley 597; Halsted meadow, region of Mt. Silliman, Dudley 1461; basin of Upper Kern River, Tulare County, 8,500 feet, Hall and Babcock 5633; wet meadows near Soda Creek, Tulare County, 10–11,000 feet, Purpus 5214.

3. SWEERTIA

1. **Sweertia perennis** L. var. **obtusa** (Ledeb.) Griseb., *in* Hook., Fl. Bor. Am., vol. 2, p. 66. 1838.

S. obtusa Ledeb., Mem. Acad. St. Petersb., vol. 5, p. 526. 1812.
S. Covillei Greene, Leaflets, vol. 1, p. 77. 1904.
S. palustris A. Nels., Bull. Torr. Bot. Club, vol. 28, p. 227. 1901.
S. congesta A. Nels. *l.c.*

Type locality.—"N.W. Coast."

Range.—Alaska southward through the mountains of British Columbia and Idaho to Oregon and California; in the Rockies to New Mexico. Washington?

Zone.—Canadian and Hudsonian.

Specimens examined.—Whitney meadows, Tulare County, 8,500 feet, Hall and Babcock 5492; Crabtree meadows, Tulare County, Culbertson (B 4553); same locality, 10,350 feet, H. M. and G. R. Hall 8449; Hockett's meadows, Tulare County, 8,500 feet, H. M. and G. R. Hall 8473.

Our Sierran material, and also the collections from the Rocky Mountains seen by me, agree excellently with European specimens and also with the plate in *Fl. Danica* (t. 2047) save in the broader, more obtuse petals and the radical leaves more obtuse, differences which seem to be distinctly of varietal rank.

4. FRASERA

Glands in pairs on each petal	1. **F. speciosa**
Glands single on each petal	2. **F. tubulosa**

1. **Frasera speciosa** Dougl., Griseb., *in* Hook., Fl. Bor. Am., vol. 2, p. 66. 1838.

Type locality.—"On the low hills near Spokane and Salmon Rivers and subalpine parts of the Blue Mountains, near the Kooskooka River."

Range.—Eastern Washington to Wyoming and south to California and New Mexico.

Zone.—Arid Transition and Canadian.

Specimens examined.—Faith Valley, Alpine County, 8,000 feet, Hansen 595; Charity Valley, Alpine County, G. Hansen in 1892; soda springs of the Tuolumne River, Yosemite, Brewer 1703, 6361; South Fork of the San Joaquin, 9,000 feet, Hall and Chandler 716.

2. **Frasera tubulosa** Coville, Proc. Biol. Soc. Wash., vol. 7, p. 71. 1892.

Type locality.—"In dry soil under *Pinus Jeffreyi* in the northeast corner of the enclosure at Soda Springs, on the north fork of Kern River, Sierra Nevada, Tulare County, California.

Range.—Southern Sierra Nevada.

Zone.—Transition and lower Canadian.

Specimens examined.—Soda Springs, type locality, 6,300 feet, Hall and Babcock 5412; Mt. Olancha, open forest of *P. Jeffreyi,* 8,500 feet, Hall and Babcock 5271; Kern River, Culbertson (B 4329).

47. APOCYNACEAE (DOGBANE FAMILY)

Corolla funnel form, ½–¾ inch long, rose-purple; style long filiform; leaves long petioled .... 1. **Cycladenia**

Corolla campanulate, ¼–⅓ inch long; pink or nearly white; style wanting; leaves short petioled .... 2. **Apocynum**

1. CYCLADENIA

1. **Cycladenia humilis** Benth., Pl. Hartw., p. 323. 1850.

Type locality.—"In montibus Sacramento."

Range.—Inner side of the North Coast Ranges, about Mt. Shasta, and in the northern Sierra Nevada.

Zone.—Canadian?

Specimen examined.—Mt. Dyer, Mrs. R. M. Austin, July, 1879.

The var. *tomentosa* Gray (Syn. Fl., vol. 2, pt. 1, suppl., p. 400, 1886), present in the Upper Sonoran and Transition life-zones, has a range extending across the Great Basin into southern Utah.

2. APOCYNUM

1. **Apocynum androsaemifolium** L. var. **pumilum** Gray, Syn. Fl., vol. 2, pt. 1, p. 83. 1878.

A. cardiophyllum Greene, Leaflets, vol. 1, p. 79. 1904.
A. bicolor McGregor, Bull. Torr., Bot. Club, vol. 37, p. 261. 1910.

Type locality.—Not precisely given.

Range.—British Columbia to southern California.

Zone.—Transition mainly, just entering the Canadian.

Specimens examined.—Above Donner Lake toward Donner Pass, Heller 7050; Mt. Tallac, 8,600 feet, Smiley 247; hillside at Soda Springs, Nevada County, 7,000 feet, Smiley 454; Silver Lake, Amador County, Hansen 969; Snow Creek, Yosemite, Congdon; Hockett's Meadows, Tulare County, Culbertson (B 4472).

48. POLEMONIACEAE (PHLOX FAMILY)

Leaves simple, not pinnate, though often finely cut or lobed; calyx at length ruptured by the maturing capsule.
  Stamens very unequally inserted; corolla strictly salverform with narrow throat; leaves entire and opposite ....1. **Phlox**
  Stamens nearly equally inserted; corolla funnel-form with limb inclined ....2. **Gilia**
Leaves pinnately divided into many leaflets; calyx distended but not ruptured by the maturing capsule ....3. **Polemonium**

1. PHLOX

Calyx glandular; leaves less than ¼ inch long ....1. **P. caespitosa**
Calyx not glandular; leaves ¼–½ inch long........................2. **P. Douglasii** var. **diffusa**

1. **Phlox caespitosa** var. **muscoides** (Nutt.) Brand, Helios, vol. 22, p. 78. 1905.

P. muscoides Nutt., Jour. Acad. Phila., vol. 7, p. 42. 1834.

P. dejecta A. Nels. and Kennedy, Proc. Biol. Soc. Wash., vol. 19, p. 37. 1906.

Type locality.—"In alpine situations at the sources of the Missouri."

Range.—Rocky Mountains of Montana and northwestern Wyoming across the Great Basin to the Sierra Nevada.

Zone.—Arctic-alpine.

Specimens examined.—Mt. Rose, 10,800 feet, Heller 9869; Silver Mountain, forms dense tufts on dry summit of the mountain at 11,000 feet, Brewer 2699; Mt. Dana, Hall and Babcock 3612; near Mt. Whitney, above timber line, V. Bailey (Death Valley 2072); Olancha Mountain, Tulare County, 11–12,000 feet, Hall and Babcock 5228.

2. **Phlox Douglasii** var. **diffusa** Gray, Proc. Am. Acad., vol. 8, p. 254. 1870.

P. diffusa Benth., Pl. Hartw., p. 325. 1849.

Type locality.—"In locis siccis saxosis prope Bear Valley in montibus Sacramento."

Range.—British Columbia south through Idaho, Washington, and Oregon to the mountains of northern California and the Sierra Nevada.

Zone.—Canadian to Arctic-alpine.

Specimens examined.—Black Butte, Sierra Buttes, Rattan 37; Gold Lake, Sierra County, 6,400 feet, Hall and Babcock 4510; high mountain near Donner Pass, Torrey in 1865; Mt. Rose, 9,650 feet, Heller 9910a; Pyramid Peak, 8–10,000 feet, W. S. Atkinson in 1900; Angora Peak, Tahoe, 7,700 feet, sandy slopes, Smiley 47; Lake of the Woods, Tahoe, 7,850 feet, McGregor 41; trail to Mt. Tallac, 9,000 feet, Abrams 4839; Silver Lake, Amador County, 8,000 feet, Hansen 499; Mono Pass, at 7,000 feet and upwards, Brewer 1719; summits near Carson Pass, 10,000 feet, Brewer 2117; Sentinel Dome, Yosemite, Dudley, June 11, 1894; Tioga Road, Yosemite, dry gravel, 9,000 feet, R. A. Ware 2611c; Mt. Dana, 10,400 feet, Smiley 716; Mt. Gibbs, 10,200 feet, Smiley 766; Mt. Goddard, 11,500 feet, Hall and Chandler 703; Mt. Lyell, 10,500 feet, Hall and Babcock 3566; region of Dinkey Creek, Fresno County, 8,900 feet, Hall and Chandler 376; Mt. Raymond, Madera County, 8,700 feet, Smiley 549.

Our form appears to be all of the variety; the species occurs in the Arid Transition and Upper Sonoran to the north and east of the Sierra and perhaps in the foothills of the range (compare *Miss C. E. Cummings,* May 5, 1896, collected at Raymond (Madera County?), 900 feet).

No collections of var. *diffusa* have been seen by me from the mountains south of Fresno County, but Miss Eastwood reports *P. Douglasii* from Bullfrog Lake, in the high mountains of Tulare County; it is probable that it is similar to the forms here referred to the variety.

2. GILIA

- Upper leaves alternate.
  - Small annuals.
    - Leaves mostly entire, the upper cauline reduced or bractlike.
      - Flowers large (½–¾ inch long), on slender naked pedicels, the corolla dark purple .... 1. **G. leptalea**
      - Flowers small (¼–⅜ inch long), on short pedicels; corolla white or rarely colored .... 2. **G. capillaris**
  - Woody biennials or perennials.
    - Plants tall (1–4 feet), biennial: leaves deeply pinnatifid: inflorescence thyrsoid-paniculate, the flowers red or yellow .... 3. **G. aggregata**
    - Plants very depressed and mat-like.
      - Perennial with leaves palmately deeply parted, the divisions acerose; flowers solitary, white or pinkish .... 4. **G. pungens**
      - Biennial with leaves palmately parted, the divisions short ovate and mucronate; flowers in dense glomerate cymes .... 5. **G. congesta**
- Leaves all opposite or apparently whorled.
  - Annuals with stems simple above; flowers purple.
    - Cells of ovary several–many ovuled; stems becoming 10–15 inches high; leaves divided into 5–7 acerose rigid divisions; bracts similar and hispid .... 6. **G. ciliata**
    - Cell of ovary 1-ovuled; stems much shorter, rarely attaining 5 inches; outer bracts oblanceolate .... 7. **G. tularensis**
  - Perennial plants with many stems rising from the base; flowers white .... 8. **G. Nuttallii**

1. **Gilia leptalea** (Gray) Greene, Erythea, vol. 4, p. 58. 1896.

Collomia leptalea Gray, Proc. Am. Acad., vol. 8, p. 261. 1870.

Type locality.—"California, in the Sierra and foothills, from Plumas to Mariposa County."

Range.—California and Oregon.

Zone.—Transition and, as a depauperate, in the Canadian.

Specimens examined.—Hills above Red Clover Valley, Plumas County, Heller and Kennedy 8710; lower end of Donner Lake, Heller 6868; Tallac, Tahoe, 6,300 feet, Smiley 135; Glen Alpine, W. A. Setchell, July 14, 1901; Camp Agassiz, near Glen Alpine, Dudley, June 28, 1900; near White Wolf, Yosemite, H. M. Evans, July, 1901; between Lake Tenaya and Tuolumne meadows, Yosemite, 8,300 feet, Smiley 703; Tuolumne meadows, foot of Lambert's Dome, 8,500 feet, Smiley 756; Tuolumne meadows, 8,600 feet, F. M. Reed 3561; Eagle Peak trail, Yosemite, E. B. Babcock, June 26, 1912; Pedlar, Amador County, 7,000 feet, Hansen 704.

2. **Gilia capillaris** Kellogg, Proc. Calif. Acad., vol. 5, p. 46. 1873.

Type locality.—"Cisco, C. P. R.R., Sierra Nevada Mountains."

Range.—Washington to California; Idaho.

Zone.—Transition and Canadian.

Specimens examined.—Gold Lake, Sierra County, 6,400 feet, Hall and Babcock 4498; Mt. Stanford (Castle Peak), Hooker and Gray in 1877; Cisco, 1850 m., Mrs. C. C. Hall 8710; dry hillside above Soda Springs, 7,200 feet, Smiley 457; Half-Moon Lake, Tahoe, McGregor 76; Tuolumne meadows, Yosemite, 8,500 feet, Smiley 742; Hockett's Meadows, Tulare County, 8,500 feet, Hall and Babcock 5628.

Gilia subalpina Greene (*in* Brand, Pflanzenr., Bd. 4, Heft 27, s. 98. 1907) though compared to *G. leptalea* in the description ("Fast stets in Begleitung der vorigen Art (*leptalea*), aber in höheren Lagen, von 2000–3000 m. Californien: Nevada Co.: Uber dem Donner-See"), is more like our No. 2. The validity of the species cannot now be determined: certainly the critical character assigned to distinguish it from *G. leptalea*—less number of ovules—cannot be depended upon.

3. **Gilia aggregata** (Pursh.) Spreng., Syst., vol. 1, p. 626. 1825.

Cantua aggregata Pursh, Fl., vol. 1, p. 147. 1814.*

Type locality.—Said in description to be from "the banks of the Mississippi," but the type actually collected in Idaho.

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* For inclusive synonymy see Brand, A., Pflanzenreich, Bd. 4, Heft 250. 1907.

Range.—Widely distributed in western North America and appearing in a number of different forms or races, which however are impossible of delimitation. Washington to Montana, south to California, Arizona, New Mexico, and western Texas.

Zone.—Arid Transition and Canadian.

Specimens examined.—Between Taylorville and Little Grizzly Creek, Plumas County, Heller and Kennedy 8831; Mt. Stanford (Castle Peak), Hooker and Gray in 1877; Tallac, Tahoe, 8,500 feet, Smiley 129; Shuteye Mountain, Madera County, 6,500 feet, J. Murdoch Jr. 2573; above Yosemite, Lemmon 53; Round meadow, Fresno County, 7,400 feet, Smiley 589; Sky Valley, Tulare County, Culbertson (B 4574); sandy places near Little Kern River, 8–9,000 feet, Purpus 5189; Mt. Olancha, Tulare County, 9,500 feet, Hall and Babcock 5265.

3a. **Gilia aggregate** var. **Bridgesii** Gray, Syn. Fl., vol. 2, pt. 1, p. 145. 1878.

G. Bridgesii Greene, Leaflets, vol. 1, p. 160. 1905.

Type locality.—"California, through the Sierra Nevada."

Range.—Sierra Nevada to Oregon.

Zone.—Canadian.

Specimens examined.—Peregoy's, above Yosemite, A. Gray in 1872; Mt. Olancha, Rothrock 358.

This variety differs from the type in deeper color of the corolla, the lobes of which are ovate, and the leaf segments thicker and more obtuse. Var. *attenuata* Gray (*l.c.*) is not certainly known from California, but may be present on the eastern slope; *Davidson* 2750 from Bishop Creek, Inyo County, at 8,100 feet, is very similar to collections referred to this variety from Utah.

4. **Gilia pungens** (Torr.) Benth, *in* DC., Prodr., vol. 9, p. 316. 1845.

Cantua pungens Torr., Ann. Lyc. N. Y., vol. 2, p. 220. 1826.

Type locality.—Not ascertained.

Range.—Rocky Mountains westward to the Pacific Coast.

Zone.—Canadian to above timber line.

Specimens examined.—Soda Springs, Sierra County, M. E. Jones 2474; near Summit Station, Heller 7031; near Marlette Peak, Nevada, gravelly ridges, 7,800 feet, Hall and Chandler 4561; Mt. Tallac, 9,600 feet, Hall and Chandler 4620; Cathedral Peak, Yosemite, dry rocks forming mats, 10,000 feet, Smiley 817; Mt. Goddard, 11,300 feet, Hall and Chandler 703½; Mt. Silliman, Tulare County, Mrs. Brandegee, August 23, 1905; region of Mineral King, Tulare County, 10,000 feet, Dudley 2579; Mt. Brewer, Tulare County, dry gravel soil, 10,000 feet, Brewer 2806.

4a. **Gilia pungens** var. **Hookeri** Gray, Syn. Fl., vol. 2, pt. 1, p. 141. 1878.

Phlox Hookeri Dougl., *in* Hook., Fl. Bor. Am., vol. 2, p. 73. 1838.

Type locality.—"Common on arid, sandy, and rocky soils near the narrows of the Oakanagan and Priest's Rapids of the Columbia (Washington)."

Range.—British Columbia to California.

Zone.—Arid Transition and Canadian.

Specimens examined.—Near Squaw Peak, Placer County, C. J. Fox Jr. in 1895; Angora Peak, Tahoe, 8,000 feet, Smiley 5; Mt. Tallac, on the east side, 9,500 feet, Smiley 238; Glen Alpine, Tahoe, W. A. Setchell, July 14, 1901; Tuolumne meadows, Yosemite, 8,600 feet, R. A. Ware 2659c; Lambert's Dome, Yosemite, 8,700 feet, Smiley 759; Kaiser Crest, Fresno County, 9,000 feet, Smiley 619; Fish Creek, Tulare County, 7,500 feet, Hall and Babcock 5207 feet.

4b. **Gilia pungens** var. **tenuiloba** Milliken, Univ. Calif. Pub. Bot., vol. 2, p. 43. 1904.

Not certainly known from the Sierra, but probably present in the mountains of Tulare County (slope of Alta Peak, *Dudley* 1541).

Var. *Hookeri* is distinguished from the species by a looser habit of growth and by the divisions of the leaves being of very unequal length, the middle lobe twice as long as the lateral lobes. Var. *tenuiloba* is unlike both the species and the above variety in having the flowers terminal and solitary; lobes of the leaves approximately equal but much less rigid than in the type species or in var. *Hookeri.* The basis for var. *tenuiloba* came from Mt. San Jacinto, Riverside County, and was collected by S. B. Parish, who first described it as *Gilia tenuiloba.*

5. **Gilia congesta** Hook. subsp. **palmifrons** Brand, Pflanzenr., Bd. 4, Heft 250, s. 121. 1907.

G. montana A. Nels. and Kennedy, Proc. Biol. Soc. Wash., vol. 19, p. 37. 1906.

Type locality.—"Oregon: Camp Harney."

Range.—East Oregon, mountains of northern California, and the Sierra Nevada, east through Nevada to Utah.

Zone.—In the Sierra Nevada, this subspecies is restricted to the Arctic-alpine, but the type (*Cusick* 869) came from the Arid Transition (if the type collection was actually made at Camp Harney).

Specimens examined.—Castle Peak, near the highest point, 9,000 feet, Heller 7100; highest point of Sierra Nevada above Donner Lake on barren stony summit, 10,000 feet, E. L. Greene 478; near Squaw Peak, Placer County, C. J. Fox Jr., July, 1895; Silver Mountain, dry soil at summit, 11,000 feet, Brewer 2055; summit between Tinker's Knob and Devil's Cliff, Tahoe, Kennedy and Doten 279; Rubicon Peak, Tahoe, in summit rocks, 9,100 feet, Smiley 409; loose dry soil at Sonora Pass, 10,000 feet, Brewer 1883; Webber Peak, Lemmon, July, 1875.

The subspecies *palmifrons* has the leaves palmately divided; the coördinate subspecies *iberidifolia* Brand, (*l.c.,* p. 121—*G. iberidifolia* Benth., *in* Hook., Jour. Bot., vol. 3, p. 290. 1851) with range in the Rocky Mountains from British Columbia to Colorado, has its leaves pinnatifid; these two subspecies are said by Brand to be "geographisch streng—geschieden," a statement needing modification in view of the collections made in northern California and adjacent Oregon; in this area certain collections have been made that show both subspecies to be present in the northwest (compare *Chandler* 1666 from Marble Mountain, Siskiyou County, 8,000 feet, in which the leaves show such an extension of the central segment that the other segments become lateral to it, i.e., the leaf becomes pinnatifid).

6. **Gilia ciliata** Benth. var. **neglecta** Brand, Pflanzenr., Bd. 4, Heft 250, p. 137. 1907.

Linanthus neglectus Greene, Erythea, vol. 3, p. 24. 1895.

Type locality.—"Common at subalpine elevations of the California Sierra."

Range.—Sierra Nevada from Sierra County to the Kings River region.

Zone.—Upper Transition and Canadian.

Specimens examined—Donner Lake, Heller 6939, 6869; Caple's Lakes, Alpine County, 8,500 feet, Hansen 512; Suzy Lake, Tahoe, Setchell and Dobie, July 16, 1901; Tallac, Tahoe, 6,600 feet, Smiley 136; Snow Creek, Mariposa County, Congdon, June (without year); Tioga Road, Yosemite, near White Wolf, 8,100 feet, Smiley 886; Snow Creek, 6,500 feet, Smiley 660 (with characters intermediate between the species and variety); summit above Peckinpah's Mill, trail to Shuteye Mountain, Madera County, 7,100 feet, Smiley 554; summit between Atwell's Mill and Redwood meadows, Tulare County, 9,000 feet, Hall and Babcock 5378.

7. **Gilia tularensis** Brand, Pflanzenr., Bd. 4, Heft 250, s. 136. 1907.

Type locality.—"Südliche Sierra Nevada: bei Smith meadow, Fish Creek, Tulare County, 2,800 m."

Range.—Known only from the type locality.

Specimens examined.—Near Smith meadow, 8,400 feet, Hall and Babcock 5211.

8. **Gilia Nuttallii** Gray, Proc. Am. Acad., vol 8, p. 267. 1870.

Linanthus Nuttallii Greene, *in* Milliken, Univ. Calif. Pub. Bot., vol. 2, p. 54. 1904.

Type locality.—Not precisely given.

Range.—Pacific Coast from Washington to southern California, east to Colorado.

Zone.—Arid Transition to Hudsonian.

Specimens examined.—Silver Mountain, Alpine County, Brewer 2042; King's Cañon, Ormsby County, Nevada, 1,700–2,000 m., Baker 1053; near Lake Tahoe, Lemmon 20; mountains west of Kaweah meadows, Tulare County, 8–9,000 feet, Purpus 5259; vicinity of mineral King, Tulare County, 8,200 feet, Hall and Babcock 5351; Farewell Gap, Tulare County, Culbertson (B 4536).

Other species of *Gilia* are frequently seen even in the high mountains, but are summer annuals of warm slopes or dry meadows (*G. Harknessii* Curran: Tuolumne meadows, gravelly soil near the Lodge 8,500 feet, Smiley 861; *G. bicolor* Brand: region of Dinkey Creek, Fresno County, 8,500 feet, Hall and Chandler 379; Tioga Road near Dark Hole, Yosemite, 7,700 feet, Smiley 860).

3. POLEMONIUM

Corolla lobes subequal to the corolla tube; leaflets entire, opposite or nearly so.
  Stems tall, solitary; style long protruding ....1. **P. occidentale**
  Stems short, clustered; style slightly exserted ....2. **P. pulcherrimum**
Corolla lobes distinctly shorter than the tube; leaflets divided, subverticillate ....3. **P. eximium**

1. **Polemonium occidentale** Greene, Pitt., vol. 2, p. 75. 1890.

P. coeruleum L., var. *pterosperma* Benth., *in* DC. Prodr., vol. 9, p. 317. 1845.

P. coeruleum of authors, as of Gray, Syn. Pl., vol. 2, pt. 1, p. 151. 1878.

P. pterospermum Brand, Helios, vol. 22, p. 77. 1905, not Nelson and Cockerell.

P. Helleri Brand, Pflanzenr., Bd. 4, Heft 250, s. 32. 1907.

Type locality.—Not given.

Range.—British Columbia to the King's River region of the Sierra Nevada; in the Rockies to Colorado.

Zone.—Transition to Hudsonian.

Specimens examined.—King's Cañon, Ormsby County, Nevada, 1,700–2,000 m., Baker; springy places near Marlette Peak, Nevada, 7,500 feet, Hall and Chandler 4586; Lake Tahoe region, W. C. Blasdale, July, 1897; Rubicon Park, Tahoe, W. A. Setchell, July 10, 1901; Mono Pass, borders of a spring at 11,000 feet, Bolander 6905; Truckee, Heller 7190; meadows on the Upper San Joaquin, Madera County, Congdon, August 20, 1895; Natural Bridge, Tulare County, 8,000 feet, Culbertson (B 4256).

P. Helleri is said to differ from all other species by the subsessile anthers; the type collected is *Heller* 7190, two sheets of which are in the herbarium at the University of California. Examination of these co-types disclosed stamens with normal length of filaments.

2. **Polemonium pulcherrimum** Hook., Bot. Mag., vol. 57, t. 2979. 1830.

P. californicum Eastwood, Bot. Gaz., vol. 37, p. 437. 1904.*

Type locality.—"On the highest of the Rocky Mountains."

Range.—Alaska to California and Colorado.

Zone.—Canadian.

Specimens examined.—Webber Lake, Lemmon; high mountain near Donner Pass, Torrey 298; near Summit Station, Donner Pass, Heller 6971; Silver Lake, Amador County, 8,000 feet, Hansen 693; mountain sides at Lake Tenaya, Yosemite, 8,300 feet, Brewer 1687; Tenaya Creek, 8,700 feet, Smiley 871; Eagle Peak meadows, Yosemite, 7,250 feet, Hall 9193; White Wolf, Yosemite, 8,000 feet, H. M. Evans, July, 1901; meadows near Black Mountain, Fresno County, 9,500 feet, Hall and Chandler 592.

2a. **Polemonium pulcherrimum** subsp. **parvifolium** Brand, Pflanzenr., Bd. 4, Heft 250, s. 35. 1907.

P. parvifolium Nutt., *in* Rydb., Bull. Torr. Bot. Club, vol. 24, p. 253. 1897.
P. viscosum Gray, Syn. Fl., vol. 2, pt. 1, p. 150. 1878, not of Nutt.
P. Tevisii Eastwood, Bot. Gaz., vol. 37, p. 440. 1904.
P. Berryi Eastwood, *l.c.*
P. montrosense A. Nels., Proc. Biol. Soc. Wash., vol. 18, p. 174. 1905.

Type locality.—Rocky Mountains.

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* This species has acquired an abundant synonymy expressive of the many forms it assumes, but it is doubtful if these variations are capable of definition, except the following subspecies (at least as regards our plants).

Range.—Northern Rocky Mountains of Montana and Wyoming, southern Cascades, and Sierra Nevada.

Zone.—Arctic-alpine.

Specimens examined.—Mt. Rose, 10,800 feet, Heller 9863; summit of Mt. Tallac, Miss H. Geiss, August, 1909; Mt. Tallac, 9,500 feet, Abrams 4833; summit of ridge between Lake LeConte and Heather Lake, 8,900 feet, Smiley 350a; summit near Ebbetts Pass, 9,000 feet, Brewer 2070.

This subspecies differs from the species in the smaller leaves, which are somewhat viscid and imbricated along the short stems. It is quite similar to *P. elegans* Greene, a doubtfully distinct species of the Cascades of Washington.

3. **Polemonium eximium** Greene, Pitt., vol. 3, p. 305. 1898.

Type locality.—"Mt. Conness."

Range.—Sierra Nevada.

Zone.—Arctic-alpine.

Specimens examined.—Mt. Stanford (Castle Peak), Lemmon (this station very doubtful, since no other collections known from north of the Yosemite region); Mt. Dana, 13,050 feet, Hall and Babcock 3603; Chesnut and Drew, July 17, 1889; at 13,000 feet, Smiley 733; Mt. Lyell, 13,000 feet, R. E. Gibbs 1746; near Mt. Goddard, 12,000 feet, Brewer 1737; Mt. Goddard, "at the very summit," 13,550 feet, Hall and Chandler 666; summit of Farewell Gap, Tulare County, Dudley 1119; Mt. Whitney, 13,800 feet, Culbertson (B 4542).

This species is the *P. confertum* of the Bot. Calif. (vol. 1, p. 500), but seems quite distinct from that Rocky Mountain alpine species.

Navarretia Breweri (Gray) Greene (Pitt., vol. 1, p. 137. 1887), described from "Sierra Nevada, at Ebbett's and Amador Pass, alt. 8,000 feet," should be mentioned as likely to be seen anywhere in the Canadian zone on dry sand slopes or rocky places in spite of being essentially an Upper Sonoran or Transition species.

49. HYDROPHYLLACEAE (WATERLEAF FAMILY)

Leaves all radical; peduncles 1-flowered ....1. **Hesperochiron**
Leaves both cauline and radical; flowers clustered (except in No. 4).
  Styles 2, distinct to the base ....2. **Nama**
  Style 2-cleft (united at least for over half its length).
    Leaves (in ours) all opposite, delicate annuals ....3. **Nemophila**
    Leaves not all opposite, nearly all alternate.
      Flowers in pedunculate heads or umbels; ovary and capsule strictly 1-celled; stamens and style long exserted ....4. **Hydrophyllum**
      Flowers in scorpoid cymes (in high mountain dwarfs sometimes so dense as to appear capitate); stamens and style shorter ....5. **Phacelia**

1. HESPEROCHIRON

Branches of the style erect.
  Corolla campanulate, with a distinct tube .... 1. **H. californicus**
  Corolla rotate, nearly divided to the base .... 2. **H. pumilus**
Branches of the style spreading .... 3. **H. campanulatus**

1. **Hesperochiron californicus** var. **latifolius** Brand., Univ. Calif. Publ. Bot., vol. 4, p. 226. 1912.

H. latifolius Kellogg, Proc. Calif. Acad., vol. 5, p. 44. 1875.

Type locality.—"On the alluvial banks of the Yuba River, subject to annual overflow, damp, sandy, and grassy plots at Cisco, C. P. R.R., Sierra Nevada Mountains, at an altitude of 6,000 feet."

Range.—Central Sierra Nevada.

Zone.—Upper Transition and lower Canadian.

Specimens examined.—South Fork of Yuba Cañon, Placer County, Mrs. C. C. Hall 8747; Cisco, Dr. A. Kellogg, June 19, 1870.

The typical form of this species, described by Bentham from a collection made by Hartweg "In uliginosis in montibus Sacramento" (*Ourisia Californica* Benth., Pl. Hartw., p. 327. 1849), has leaves slightly narrower and the peduncles glabrous. This variety is doubtfully distinct with somewhat broader leaves and peduncles pubescent.

2. **Hesperochiron pumilus** Porter, *in* Hayden, Geol. Rep., p. 768. 1872.

Villarsia pumila Dougl., *in* Hook., Fl. Bor. Am., vol. 2, p. 70. 1838.

Type locality.—Not definitely given.

Range.—Washington to Wyoming, south to California and Nevada.

Zone.—Arid Transition and Canadian.

Specimens examined.—Trail from Snow Creek to the Tioga Road, in damp swales, 7,800 feet, Smiley 674; Cloud's Rest Trail, Yosemite, 7,400 feet, Smiley 501; Glacier Point, Yosemite, 7,300 feet, Hall 9138.*

Dr. Greene considered our Sierran plant to be distinct from the common form of the north end of the Great Basin and described it as *Capnorea ciliata* (Pitt., vol. 5, p. 44. 1902). Brand (Univ. Calif. Publ. Bot., vol. 4, p. 227. 1912) has reduced this proposed species to varietal rank, the critical difference being the somewhat smaller size of the flower. If future study should justify this segregation, our Sierran form will afford another illustration of what seems to be a general rule, that genera, ranging widely in the mountains of the west, commonly show in the Sierra one or more peculiar forms.

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* It is of some interest to note that this specimen was determined by Dr. Brand as belonging to the typical form sometime before his paper appeared (Brand, *l.c.*) containing the statement "Die typische Form fehlt auf der Sierra."

3. **Hesperochiron campanulatus** Brand, Univ. Calif. Publ. Bot., vol. 4, p. 227. 1912.

Capnorea campanulata Greene, Pitt., vol. 5, p. 52. 1902.

Type locality.—"At 7,500 feet (therefore subalpine) on the North Fork of King's River, California." Hall and Chandler 550.

Range.—Sierra Nevada.

Zone.—Canadian?

Specimen examined.—North Fork of King's River, Tulare County, 7,400 feet, Hall and Chandler 550.

This collection shows a plant with some characters unlike those of *H. pumilus* as described or presented in the specimens of that species seen by me, but that it will be possible to maintain it as specifically distinct appears questionable inasmuch as a plant found by G. D. Butler (No. 1210) in the Siskiyou Mountains is clearly only a form of *H. pumilus,* yet its divergent style-branches exhibit the chief distinguishing character of *H. campanulatus.*

2. NAMA

1. **Nama Lobbii** Gray, Proc. Am. Acad., vol. 6, p. 37. 1862.

Type locality.—Not given except as "California, Lobb, No. 108."

Range.—Sierra Nevada to the mountains of northern California (Mt. Shasta).

Zone.—Transition and Canadian.

Specimens examined.—Sardine Lake, Sierra County, Hall and Babcock 4490; Webber Lake, Lemmon; Soda Springs, 2,300 m., Jones 2496; Cisco, rocks above snowsheds, Miss H. Walker 1490.

Greene referred this species to *Eriodictyon,*[115] but its real affinities appear to be with *Nama.*[116] The entire, revolute, white-woolly leaves of this depressed half-shrub distinguish it from another species of *Nama* (*N. Rothrockii* Gray, Bot. Calif., vol. 1, p. 621. 1876), found in the southern Sierra and mountains of southern California, with deeply-lobed or pinnatifid, viscid leaves and wholly herbaceous stems, which in places rises to our borders or even above them in exceptionally favorable situations.

3. NEMOPHILA

Style scarcely bifid, very small	1. **N. spathulata**
Style divided to the middle at least, as long as the ovary	2. **N. humilis**

1. **Nemophila spathulata** Coville, Contr. Nat. Herb., vol. 4, p. 156. 1893.

N. inconspicua Eastw., Bull. Torr. Bot. Club, vol. 28, p. 144. 1901.
N. pratensis Eastw., Bull. Torr. Bot. Club, vol. 29, p. 474. 1902.

Type locality.—"In Whitney meadows, Sierra Nevada."

Range.—Sierra Nevada, perhaps only in the southern half. Tehachapi Mountains, acc. to Davidson (Muhl., vol. 4, p. 66. 1908). San Jacinto Mountains.

Zone.—Transition and Canadian.

Specimens examined.—North side of Toowa Range, Tulare County, 9,000 feet, H. M. and G. R. Hall 8405; Volcano meadows (formerly called Whitney meadows), Tulare County, Hall and Babcock 5487.

This species is very close to *N. pedunculata* Dougl., a species ranging from Washington to the Coast Ranges of California.[117]

2. **Nemophila humilis** Eastw., Bull. Torr. Bot. Club, vol. 28, p. 150. 1900.

Type locality.—"On the trail between Summit and Summit Soda Springs, in Placer County." *Eastwood.*

Range.—Central Sierra Nevada.

Zone.—Transition, rising into the Canadian.

Specimens examined.—Emigrant Gap, Jones 2816; near White Wolf, Yosemite, 8,000 feet, H. M. Evans, July, 1901; Snow Flat, Yosemite, Eastwood, July 12, 1902; Yosemite Falls, 6,750 feet, Chandler and Babcock 1086.

4. HYDROPHYLLUM

1. **Hydrophyllum occidentale** var. **Watsoni** Gray, Proc. Am. Acad., vol. 10, p. 314. 1875.

H. macrophyllum var. *occidentale* Wats., Bot. King's Exped., p. 248. 1871.

Type locality.—"Hillsides, Duffield's Ranch, Sierra Nevada."

Range.—California to Utah.

Zone.—Transition, rising into the Canadian.

Specimens examined.—Haskell's Peak, Lemmon 1130; Summit, 7,000 feet, Heller 9838; Independence Lake, 7,000 feet, Hall and Babcock 4533a; Summit Camp, Kellogg, July 10, 1870; between Fallen Leaf Lake and Glen Alpine, Tahoe, 6,800 feet, Smiley 273.

5. PHACELIA

Annuals; styles deeply divided almost to the base; leaves entire.
  Leaves opposite.
    Sepals ciliate and equal in length; plants 3–10 inches high .....1. **P. racemosa**
    Sepals densely pilose and unequal; plants 1.5–3 inches high ..2. **P. orogenes**
  Leaves all, or at least the upper, alternate.
    Styles longer than the calyx, united for ⅓ their length; plant 4–10 inches high ....3. **P. humilis**
    Styles about as long as the calyx and separate to the capsule; plant 3–5 inches high ....4. **P. Eisenii**
Perennials.
  Leaves pinnate, green, the leaflets deeply lobed ....5. **P. ramosissima** var. **decumbens**
  Leaves not pinnate, gray hirsute or pilose.
    Leaves (in ours) entire, hirsute, or with a pair of small lateral basal leaflets, the terminal lobe then always far larger ....6. **P. magellanica**
    Leaves pilose, saliently toothed but never divided or truly pinnatifid ....7. **P. hydrophylloides**

1. **Phacelia racemosa** T. S. Brandegee, Zoe, vol. 2, p. 252. 1891.

Nama racemosa Kellogg, Proc. Calif. Acad., vol. 5, p. 51. 1873.
Phacelia namatoides Gray, Proc. Am. Acad., vol. 10, p. 317. 1873.

Type locality.—"At Cisco." Kellogg and Brannan, July 6, 1870.

Range.—Sierra Nevada and North Coast Ranges.

Zone.—Canadian.

Specimens examined.—Summit Sierra Nevada, Kellogg, July 6, 1870; Cisco, Mrs. Brandegee, July 15, 1908; about Summit Station, 7,000 feet, Heller 6981; Jameson Creek, 6,300 feet, Hall 9354; Dinkey Creek, 7,500 feet, Hall and Chandler 435; Glacier Point, 7,500 feet, Hall 9146.

2. **Phacelia orogenes** Brand, Beitrage z. Jahresb. d. Konigl. Gymnasium zu Sorau, p. 7. 1911.

Type locality.—"Californien: Auf der sudlichen Sierra Nevada in 2750 m. Hohe.—Tulare County: Vicinity of Mineral King. Moist hillside on Eagle Lake trail."

Range.—Known only from the type locality.

Zone.—Canadian (?).

Specimen examined.—Vicinity Mineral King, moist hillside on Eagle Lake trail, 8,500 feet, Hall and Babcock 5354.

3. **Phacelia humilis** T. and G., Pac. R.R. Rep., vol. 2, p. 122. 1855.

Type locality.—"Near the summit of the Sierra Nevada, California." J. A. Snyder.

Range.—Sierra Nevada throughout its length; in the Tehachapi Mountains, acc. Davidson.[118]

Zone.—Mainly Transition but rising into the Canadian.

Specimens examined.—East side Mt. Rose, 8,430 feet, Heller 10946; Pyramid Peak, west side, W. L. Atkinson in 1900; Cisco Butte, 6,500 feet, Hall 8756; White Wolf, 8,000 feet, H. M. Evans; Mineral King, T. S. Brandegee, July 27, 1892.

4. **Phacelia Eisenii** T. S. Brandegee, Zoe, vol. 2, p. 252. 1891.

Type locality.—"Collected by Dr. Gustav Eisen in Fresno County, 1880, also collected near Yosemite, and by the writer in moss on wet rocks at Frazier's Mill, in the mountains above Porterville."

Range.—Southern Sierra.

Zone.—Transition and rising into the Canadian locally.

Specimens examined.—Bald Mountain, Dinkey Creek region, 8,500 feet, Hall and Chandler 378; Mineral King, T. S. Brandegee; Alta meadows, Mrs. K. Brandegee.

5. **Phacelia ramosissima** Dougl., *in* Benth., Trans. Linn. Soc., vol. 17, p. 280. 1834.

Phacelia decumbens Greene, Pitt., vol. 5, p. 17. 1902.
Phacelia fastigiata Greene, Pitt., vol. 5, p. 18. 1902.

Type locality.—Dry rocky plains of the Columbia near Priest's Rapids and at the Stony Island." Douglas.

Range.—Pacific Coast from British Columbia to Arizona and southern California.

Zone.—Arid Transition to Canadian, perhaps in the Upper Sonoran.

Specimens examined.—Donner Pass, Heller 7032; Grass Lake, 7,200 feet, McGregor 101; Marlette Peak, Hall and Chandler 4570; Mt. Silliman, on Clover Creek, Dudley 1472; Mineral King, 7,800 feet, Hall and Babcock 5666.

Dr. Brand[119] proposes to distinguish our Sierran form of this widely ranging plant by accepting Greene's *P. decumbens* as a *form* distinct by its reclining habit, a character which, in my opinion, is not sufficiently marked to call for nomenclatural notice.

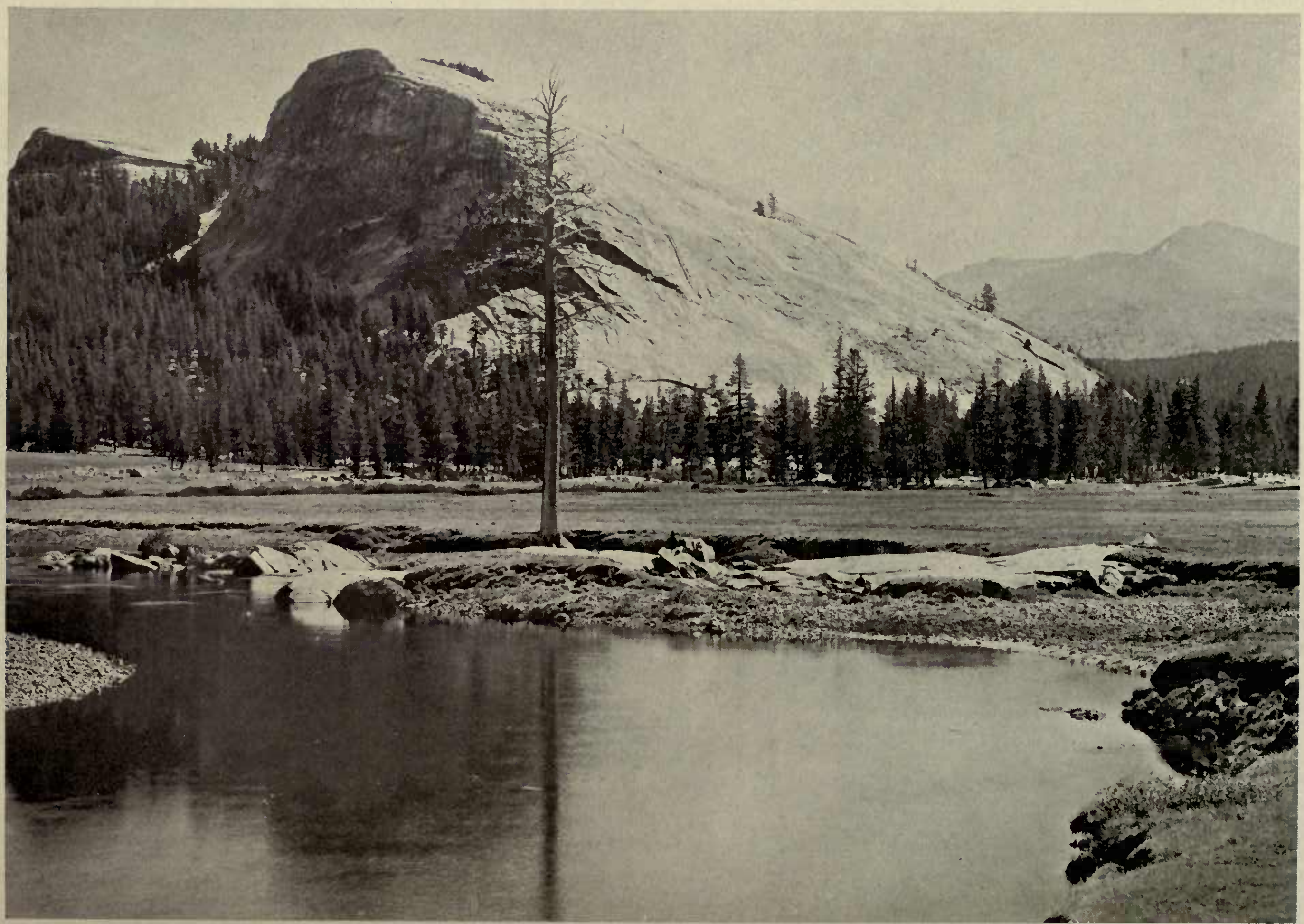
6. **Phacelia magellanica** (Lam.) Coville, Contr. Nat. Herb., vol. 4, p. 159. 1893.

Hydrophyllum magellanica Lam., Jour. Hist. Nat., vol. 1, p. 373. 1787.

Type locality.—South America, Patagonia.

Range.—Western North America from British Columbia to Saskatchewan, south to Colorado and California. South America (Patagonia).

Zone.—Arid Transition to Arctic-alpine.



CANADIAN MEADOW AND FOREST, YOSEMITE REGION; UPPER TUOLUMNE RIVER, WITH LAMBERT'S DOME, MT. DANA ON THE EXTREME RIGHT.

Specimens examined.—Glen Alpine trail to Mt. Tallac, 9,300 feet, Abrams 4841; Dick's Peak, Tahoe, 9,900 feet, Smiley 428; Mt. Tallac, above highest timber, 9,700 feet, Hall and Chandler 4632; Mt. Rose, 10,000 feet, Kennedy 1141; ridge above Suzy Lake, 8,900 feet, Smiley 152; Silver Mountain, 11,000 feet, Brewer 2051; Tuolumne meadows, dry gravelly slope of open pine forest, 8,800 feet, R. A. Ware 2660c; Ragged Peak, Yosemite, 9,700 feet, Smiley 834; Lambert's Dome, 9,000 feet, Smiley 760; Lake Tenaya, dry ground, 8,300 feet, Smiley 868; Kaiser Crest, Fresno County, 9,400 feet, Smiley 627; Alta meadows, Mrs. Brandegee, August 6, 1905; Mt. Whitney, Culbertson (B 4355).

This is one of the most variable of western plants. Many attempts have been made to bring order into its numberless changes of form; one of the most recent is that of Dr. A. Brand.[119] He proposes to recognize but a single species but tries to differentiate between some ten forms while cognizant of the fact that they are "nur zum Teil geographisch geschieden und gehen oft so weit in einander über dass man sie mit Sicherheit nicht unterscheiden kann." Dr. Brand maintains that all the North American forms belong to one section of the species, having the filaments bearded, while the other section, in South America, has the filaments naked or with a few scattered hairs ("Filamenta nuda raro pilis paucissimis adspersa"). I have had no opportunity to examine the South American material but if this contrast (bearded vs. essentially naked filaments) indeed marks the natural division among the forms, it is not necessary to go to the other end of the hemisphere for examples since the specimen of Culbertson's, cited above, has the filaments nearly free from any hairs. In fact, the variation in the amount of hairiness of the filaments seen in many of the specimens examined, suggests that the variability of this plant, disclosed in its protean changes of foliage characters, habit, and duration of growth, and recognized by Dr. Brand in his skillful arrangement of these permutations, affects also the basis for his specific sections.

7. **Phacelia hydrophylloides** Torr., *in* Gray, Proc. Am. Acad., vol. 7, p. 400. 1868.

Type locality.—"Ebbett's Pass, and near Lake Tenaya, 8–9,000 feet, Brewer. Open woods along the trail of the Yosemite, from 8,000 down to 5,000 feet, Bolander."

Range.—Sierra Nevada.

Zone.—Canadian.

Specimens examined.—Summit Station, Kellogg; near Frog Lake at foot of Castle Peak, Heller 7071; divide on south side of Slide Mountain, in granite, 7,600 feet, Heller 10931; Deer Park, meadows, 6,500 feet, Miss H. Walker 2081; Ebbett's Pass and Lake Tenaya, Brewer 1683; Sentinel Dome, Gray in 1872; Glacier Point, 7,200 feet, Hall 9152; between Lake Tenaya and Tuolumne meadows, 8,100 feet, Smiley 702; south slope of Kaiser Crest, 9,400 feet, Smiley 627; Alta meadows, 10,000 feet, G. B. Grant 2091; Hockett's meadows, Culbertson (B 4456); open woods along Soda Creek, 8–9,000 feet, Purpus 5154; trail to Panther Peak, Dudley 1268.

The genus *Romanzoffia* Cham. sends one species (*R. sitchensis* Bong.) down the coast from Alaska as far as San Mateo County, California, where it is found in moist sea-facing cañons in the Coast Redwood forests. In Washington, this species is Hudsonian and Canadian, according to Piper. It is not known from the Sierra, but there exists in the Herbarium of the University of California part of a plant, too fragmentary for certain reference but probably belonging to this species, said to have been found with a collection of *Phacelia humilis* taken at Glen Alpine by Chesnut and Drew, August 8, 1890. It seems altogether probable that this association was subsequent to the reception of the specimens at the herbarium.

Draperia systyla Torr. (*in* Gray, Proc. Am. Acad., vol. 7, p. 401. 1868), a monotypic genus peculiar to California, is widely distributed in the Transition zone throughout the Sierra, rising to our lower border. (Trail to Pitman Creek, Fresno County, 6,500 feet, Smiley 572).

50. BORRAGINACEAE (Borage Family)

Annual plants of small size and with inconspicuous flowers.
  Calyx persisting entire about the nutlets .... 1. **Cryptanthe**
  Calyx circumscissile, the upper 5-lobed part early deciduous and falling away, leaving a ring about the nutlets .... 2. **Greeneocharis**
Perennials of larger size and conspicuous flowers.
  Nutlets armed with (usually glochidiate) prickles; fruit bur-like .. 3. **Lappula**
  Nutlets unarmed, smooth or merely muriculate or rugose, never bur-like.
    Flowers blue .... 4. **Mertensia**
    Flowers white or yellow .... 5. **Oreocarya**

1. CRYPTANTHE

1. **Cryptanthe affinis** Greene, Pitt., vol. 1, p. 119. 1887.

Krynitzkia affinis Gray, Proc. Am. Acad., vol. 20, p. 270. 1885.
Cryptanthe geminata Greene, *l.c.*

Type locality.—"E. side of the Cascades near lat. 49°."

Range.—Pacific Coast from Washington and Idaho to California.

Zone.—Transition rising into the Canadian.

Specimens examined.—Camp Agassiz, near Glen Alpine, Tahoe, Dudley, June 28, 1900; Pedlar, Amador County, 7,000 feet, Hansen 516; Cathedral trail to Mt. Tallac, Tahoe, 7,000 feet, Smiley 219.

This species is common in the Sierra in the Yellow Pine belt; its inclusion here is of doubtful propriety, the only reason being that it is likely to be found in the *Pinus ponderosa* var. *Jeffreyi* division of the Canadian zone.

2. GREENEOCHARIS

1. **Greeneocharis circumscissa** Rydb. (Bull. Torr. Bot. Club, vol. 35, p. 677. 1909), a small annual widely dispersed in the Great Basin region from British Columbia to Lower California and growing typically in the Upper Sonoran life-zone, appears to have a variant in the boreal region of the Sierra, which was collected by *Culbertson* (B 4243) on the trail to Mt. Whitney and has been described as the var. *hispida* by Macbride.[120] The specimen has not been seen by me.

3. LAPPULA

- Flowers white; corolla tube not exceeding the calyx .... 1. **L. californica**
- Flowers blue.
  - Corolla tube shorter than the calyx lobes; nutlets prickly only on the margins; corolla rotate; plants gray .... 2. **L. floribunda**
  - Corolla tube longer than the calyx lobes; nutlets prickly all over the backs and margins; corolla open funnelform.
    - Plants green, the leaves harsh with scabrid pubescence; stems smooth and nearly glabrous .... 3. **L. nervosa**
    - Plants grayish, the leaves and stems densely soft pubescent ....4. **L. velutina**

3. LAPPULA

1. **Lappula californica** Piper, Bull. Torr. Bot. Club, vol. 29, p. 546. 1902.

Type locality.—"California: Mt. Shasta, 6,000 ft. alt., 23 August, 1881, Pringle."

Range.—Mountains of northern California and through the Sierra Nevada.

Zone.—Transition, rising into the Canadian.

Specimens examined.—Vicinity of Glen Alpine, Tahoe, Reed and Pendleton 276; near Snow Flat, Yosemite, H. M. Evans, July, 1901; Hockett's meadows, Tulare County, Culbertson (B 4471), the fruit too immature for certain reference.

2. **Lappula floribunda** (Lehm.) **Greene**, Pitt., vol. 2, p. 182. 1891.

Echinospermum floribundum Lehm., Pugillus, vol. 2, p. 24. 1830.

Type locality.—"Lake Pentanguishene to the Rocky Mountains."

Range.—British Columbia to Saskatchewan, south to California and New Mexico.

Zone.—Transition mainly, rising into the Canadian.

Specimens examined.—About Marlette Lake, east of Lake Tahoe, 2,460 m., Baker 1293; Hunter Creek, Washoe County, Nevada, 6,000 feet, Kennedy 1904; summit above Lake Tahoe, Mrs. Brandegee, July 12, 1908; Suzy Lake trail, Tahoe, 7,800 feet, Smiley 149; Rock Creek, Upper Kern River, Hall and Babcock 5524; Alta meadows, Tulare County, Mrs. Brandegee, August 7, 1905.

3. **Lappula nervosa** Greene, Pitt., vol. 2, p. 182. 1891.

Echinospermum nervosum Kellogg, Proc. Calif. Acad., vol. 2, p. 146. 1862.
Lappula Jessicae McGregor, Bull. Torr. Bot. Club, vol. 37, p. 262. 1910.

Type locality.—"From the headwaters of Carson River."

Range.—Mountains of california from Mt. Shasta south through the Sierra Nevada.

Zone.—Canadian mainly.

Specimens examined.—Mt. Stanford (Castle Peak) at Frog Lake, Sonne, July 17, 1892; Summit, 6,800 feet, Heller 10591; Silver Lake, Amador County, 8,000 feet, Hansen 427; Carson Spur, Alpine County, 8,500 feet, Hansen 726; Glacier Point, Yosemite, Miss Eastwood, July 5–19, 1902; Yosemite Creek and Indian Cañon, 7,300 feet, Hall and Babcock 3459; Tioga Road, Yosemite, below White Wolf, 7,800 feet, Smiley 895; Big Oak Flat Road, Tuolumne County, Congdon 54.

4. **Lappula velutina** Piper, Bull. Torr. Bot. Club, vol. 29, p. 546. 1902.

Type locality.—"General Grant Grove (Tulare County)."

Range.—Mountains of California.

Zone.—Transition mainly, rarely above.

Specimens examined.—Luther's Pass, Tahoe region, 7,800 feet, Abrams 4762; slope above Tallac, Tahoe, 6,500 feet, Smiley 130.

Though this Lappula is a common species in the Transition, it rarely occurs within our borders and perhaps should not be considered as a component of the boreal flora.

4. MERTENSIA

1. **Mertensia stomatechioides** Kellogg, Proc. Calif. Acad., vol. 2, p. 148. 1861.

Type locality.—"Near the head-waters of the Carson River."

Range.—Sierra Nevada and mountains of southern California.

Zone.—Canadian.

Specimens examined.—About Marlette Lake, Washoe County, 2,460 m., Baker 1302; Snow Valley, Ormsby County, 2,460–2,615 m., Baker 1154; Pyramid Peak, Tahoe, 9,500 feet, Smiley 121; cañon near Sardine Valley, Nevada County, Sonne, June, 1887; White Wolf, Yosemite, 8,000 feet, H. M. Evans, July, 1901; Collins meadow, Fresno County, 7,500 feet, Hall and Chandler 456; Hockett's meadows, Tulare County, Culbertson (B 4375); Mt. Silliman, Tulare County, Mrs. Brandegee; near Farewell Gap, Tulare County, 10,200 feet, Purpus 5233; southern Sierras, Bolander 2487; Soda Springs, Kern River, Tulare County, 8,500 feet, Rothrock 421.

This plant, the only Mertensia of the Sierran region, is very close to and perhaps ought to be considered as only a variety of *M. ciliata* (James) G. Don (Gen. Syst., vol. 4, p. 372. 1838), a species ranging from Washington to Colorado.

5. OREOCARYA

Nutlets ovate, smooth or barely rugose on the backs; inflorescence contracted into 1–several dense clusters .... 1. **O. nubigena**
Nutlets oblong-ovate; tuberculate on the back, the tubercules in parallel rows: inflorescence spiciform .... 2. **O. echinoides**

1. **Oreocarya nubigena** Greene, Pitt., vol. 3, p. 112. 1896.

Type locality.—"On Cloud's Rest, Mariposa Co., California."

Range.—Sierra Nevada, and in northern Nevada, according to Macbride (Contr. Gray Herb., n.s., vol. 48, p. 31. 1916).

Zone.—Hudsonian and Arctic-alpine.

Specimens examined.—Summit of Cloud's Rest, Chesnut and Drew, July 13, 1889; Mt. Dana, Congdon, August 10, 1898; below Cloud's Rest, A. Gray in 1872; summit of Mt. Silliman, 11,188 feet, Dudley 1498; mountains near Mt. Whitney, 11–12,000 feet, Purpus 1636.

2. **Oreocarya echinoides** (Jones) Macbride, Contr. Gray Herb., n.s., vol. 48, p. 31. 1916.

Krynitzkia echinoides Jones, Proc. Calif. Acad., II, vol. 5, p. 709. 1895.

Type locality.—"Pahria Cañon, Utah."

Range.—California, from the east slope of the Sierra Nevada, to Utah.

Zone.—Arid Transition to Hudsonian.

Specimens examined.—Castle Peak, near the highest point, Heller, August 3, 1903; same locality, Sonne, July, 1892; rocky peak on Truckee River, Placer County, Sonne in 1886–87; Silver Mountain, Alpine County, 8,000 feet (no collector named, but probably collected on the State Survey).

51. LABIATAE (Mint Family)

1. MONARDELLA

Calyx ¼–⅜ inch long; bracts herbaceous or only faintly colored; stems slender, wiry .... 1. **M. Sheltoni**

Calyx shorter (little more than ⅛ inch long); bracts rose-colored; stems stout .... 2. **M. odoratissima**

1. **Monardella Sheltoni** Torr., Jour. Acad. Phila., n.s., vol 3, p. 99. 1855.

M. villosa var. *glabella* Gray, Proc. Am. Acad., vol. 7, p. 386. 1867. Bot. Calif., vol. 1, p. 593. 1876.

Type locality.—Not given; collected by Pratten in California "in the vicinity of Nevada."

Range.—Sierran region.

Zone.—Transition and Canadian.

Specimens examined.—Pine woods near Donner Lake, E. L. Greene 459; near Marlette Peak, Washoe County, Nevada, gravelly ridges, 8,000 feet, Hall and Chandler 4567; Angora Peak, Tahoe, 7,600 feet, Smiley 7; south hillside above Hermit Valley, Alpine County, 8–8,500 feet, Hall and Chandler 4770; slope above Round meadow, Fresno County, 7,300 feet, Smiley 588; near Mineral King, Tulare County, 2,750 m., Coville and Funston 1386; Tar Gap region, Tulare County, Culbertson (B 4448).

2. **Monardella odoratissima** Benth., Lab., p. 332. 1834.

M. pallida Heller, Muhl., vol. 1, p. 36. 1904.
Madronella odoratissima Greene, Leaflets, vol. 1, p. 168. 1906.
Madronella pallida Heller, Muhl., vol. 1, p. 138. 1906.

Type locality.—"In America boreali-occidentali: in petrosis ad flumen Columbia et in rupibus alpestribus in montibus White Mountains dictis."

Range.—Washington to southern California, east to Idaho and Utah.

Zone.—Transition to Hudsonian.

Specimens examined.—Ridge near lower end of Donner Lake, Heller 6959; Deer Park, Tahoe, E. J. Newcomer in 1909; Grass Lake, Tahoe, McGregor 3; Luther's Pass, Tahoe, 7,800 feet, Abrams 4760; Gilmore Lake, west side of Mt. Tallac, C. J. Fox Jr., July, 1895; Silver Lake, Amador County, 7,200 feet, E. Mulliken 133; Mt. Rose, 9,300 feet, Heller 10345; dry mountain top on Ebbett's Pass, 8,500–9,000 feet, Brewer 2006; Half-Moon Lake, Tahoe, 8,100 feet, Hall 8821; near Tuolumne meadows, Yosemite, 8,500–9,500 feet, Hall and Babcock 3626; Cloud's Rest, A. Gray in 1872; vicinity of Lundy, Mono County, 8–9,000 feet, Miss M. Minthorn 90; South Fork of the San Joaquin, slopes up to 9,500 feet, Hall and Chandler, July, 1900; Kaiser Crest, Fresno County, 8,600 feet, Smiley 616; same locality, 9,700 feet, Smiley 646; rocky mountain slopes, Little Kern River, Tulare County, 9–10,000 feet, Purpus 2032; near Whitney meadows, Tulare County, 3,000 m., Coville and Funston 1646; Farewell Gap, Tulare County, 10,200 feet, Purpus 1493.

This species forms no small part of the talus vegetation in the Canadian and Hudsonian zones, in places covering the slopes so thickly as to form a kind of dwarf chaparral.

Agastache urticifolia (Benth.) Rydb. (Mem. Dept. Bot. Columbia Univ., vol. 2, p. 359. 1900), a common Transition species of rich moist ravines and meadows, occasionally rises above our lower limits (Charity Valley, Alpine County, 8,000 feet, Hansen 437; Snow Creek trail to Lake Tenaya, Yosemite, 7,100 feet, Smiley 664).

Chamesaracha nana Gray (Proc. Am. Acad., vol. 10, p. 62), a nearly acculescent tufted perennial species peculiar to California and the Tahoe region of Nevada and belonging to a genus confined to the arid southwest from Texas to California, occurs in the Transition and rarely above in the Sierra north to Mt. Rose, 9,000 feet, Kennedy 1720).

52. SCROPHULARIACEAE (Figwort Family)

Stamens 5, one being sterile.
  Sterile stamen elongated ....1. **Pentstemon**
  Sterile stamen rudimentary and gland-like ....2. **Collinsia**
Stamens less than 5.
  Stamens 2 ....3. **Veronica**
  Stamens 4.
    Corolla closed in the throat by a palate; capsule opening by pores ....4. **Antirrhinum**
    Corolla not closed in the throat by a palate; capsule valvate.
      Stamens not included in the upper lip of the corolla; leaves mostly opposite ....5. **Mimulus**
      Stamens included in the upper lip of the corolla; leaves mostly alternate.
        Anther cells equal, parallel, and alike in all 4 stamens ....6. **Pedicularis**
        Anther cells unequal or dissimilar, the outer affixed by its middle, the inner pendulous by its upper end and usually smaller.
          Corolla lips very unequal, the lower not saccate ....7. **Castilleja**
          Corolla lips subequal, the lower saccate ....8. **Orthocarpus**

1. PENTSTEMON

Anther cells dehiscent their whole length or nearly so (section *Eupentstemon*).
  Anthers comose with long hairs ....(*P. Menziesii*)
    Leaves nearly or quite entire; flowers purple 1. **P. Menziesii var. Davidsonii**
    Leaves serrate; flowers reddish ....2. **P. Newberryi**
  Anthers not comose but glabrous (except occasionally a few hairs in *P. glaber*).
    Flowers white or yellowish ....3. **P. deustus**
    Flowers purplish.
      Flowers verticillate; sterile filament hairy ....4. **P. procerus**
      Flowers paniculate; sterile filament naked.
        Inflorescences and calyces glandular ....5. **P. heterodoxus**
        Inflorescences and calyces glabrous ....6. **P. glaber**
Anther cells confluent at apex and dehiscing only to the middle, the anther in anthesis horseshoe-shaped (section *Saccanthera*).
  Sterile filament slightly hairy ....7. **P. gracilentus**
  Sterile filament glabrous.
    Inflorescence and calyx glandular or viscid ....8. **P. Roezli**
    Inflorescence and calyx not glandular or viscid ....9. **P. azureus**

1. **Pentstemon Menziesii** var. **Davidsonii** (Greene) Piper, Contr. Nat. Herb., vol. 11, p. 499. 1906.

P. Davidsonii Greene, Pitt., vol. 2, p. 241. 1892.

Type locality.—"On Mt. Conness, at an altitude of 12,300 feet."—Yosemite region.

Range.—Southern Sierra Nevada northward through the Sierra and Cascades to Washington.

Zone.—Arctic-alpine, rarely in the Hudsonian.

Specimens examined.—Mt. Rose, 10–10,800 feet, Kennedy 1273; same locality, 10,800 feet, Kennedy 1182; same locality, 9,650 feet, Heller 9898; Mt. Tallac, Tahoe, 9,500 feet, Smiley 231; Mono Pass, rocks at summit, 9–12,000 feet, Brewer 1721; same locality, exposed rocky summit of pass, 10,700 feet, R. A. Ware 2609c; Mt. Gibbs, Yosemite, 11,600 feet, Smiley 777; rocks above Elizabeth Lake, Yosemite, 10,000 feet, Smiley 806; Mt. Goddard, 11,500 feet, Hall and Chandler 705; Kaiser Peak, Fresno County, 9,800 feet, Smiley 636; summit of Farewell Gap, Tulare County, Dudley 1120; same locality, 10,800 feet, Purpus 2061; Denel's Peak, Tulare County, 13,000 feet, Hall and Babcock 5506; above timber line on mountain north of Whitney meadows, Coville and Funston 1665; divide between Mt. Dana and Mt. Gibbs, 11,000 feet, H. M. Evans, July, 1901; Mt. Dana, E. R. Drew, July 30, 1887; Mt. Lyell, on Cassiope Crest, 11,000 feet, Hall and Babcock 3574; Sawtooth Peak, Tulare County, 12,000 feet, Hall and Babcock 5674; slope of Black Peak, Kaweah Peaks, Tulare County, 12,000 feet, Dudley 2127; Monarch Lake, Tulare County, 11–12,000 feet, Dudley 1613.

2. **Pentstemon Newberryi** Gray, Pac. R. R. Rep., vol. 6, p. 82, t. 14. 1857.

Type locality.—"On rocks, forming broad tufts near Mount St. Joseph's, N. California."

Range.—Mt. Shasta and southward in the Sierra Nevada to Tulare County.

Zone.—Canadian and Hudsonian, rarely in the Transition.

Specimens examined.—Hunter Creek Cañon, Washoe County, Nevada, 6,500 feet, Heller 10467; about Marlette Lake, Washoe County, 2,460 m., Baker 1256; Glen Alpine, Tahoe, 7,000 feet, W. W. Price, July 12, 1898; Suzy Lake, Tahoe, 7,650 feet, McGregor 114; near Heather Lake, Tahoe, 8,100 feet, Smiley 165; Silver Lake, Amador County, 8,000 feet, Hansen 451; Shuteye Pass, Sierra National Forest, 7,000 feet, Abrams 4453; Dark Hole, Yosemite, H. M. Evans, July, 1901; Cloud's Rest, 8,400 feet, Smiley 511; Lake Tenaya, Yosemite, 8,200 feet, Smiley 679; Tuolumne Meadows, dry cliffs, 8,600 feet, R. A. Ware 2664c; slopes of Mt. Lyell, Chesnut and Drew, July 26, 1889; Shuteye Mountain, Madera County, 8,100 feet, Smiley 570; above Mineral King, 2,750 m., Coville and Funston 1494; forks of Little Kern River, Tulare County, 9–10,000 feet, Purpus 5207; Mt. Goddard, 9,800 feet, Hall and Chandler, July 24–26, 1900; Mt. Olancha, Tulare County, 10,400 feet, Rothrock 50, 332; rocks on Middle Tule River, Tulare County, 9–10,000 feet, Purpus 5267.

Though Dr. Gray subsequently (Syn. Fl., vol. 2, pt. 1, p. 259) reduced this to a variety of *P. Menziesii* Hook., its distinctly separate range and consistent exhibition of a quite differently colored corolla seem sufficient warrant for maintaining it as a species. *P. Menziesii* Hook. (Fl. Bor. Am., vol. 2, p. 98), in its typical form, ranges from British Columbia through Washington to Oregon and is also found on the mountains of Idaho; the color of the corolla is always violet-blue.

3. **Pentstemon deustus** Dougl., *in* Lindl., Bot. Reg., vol. 16, pl. 1318. 1830.

Type locality.—''Native of northwest America, where it was found by Mr. Douglas on scorched, rocky plains, in the interior.''

Range.—East side of the Sierra from Lake Tahoe northward to Washington and east to western Wyoming and Montana.

Zone.—Arid Transition, rising into the Canadian.

Specimens examined.—Independence Lake, Sierra County, Dudley, June 19, 1900; upper end of Donner Lake, Heller 6967; among rocks near Fallen Leaf Lake, Tahoe, Miss Lathrop, July 12, 1909; Angora Peak, Tahoe, 7,200 feet, Smiley 29; Fallen Leaf trail to Mt. Tallac, 8,000 feet, Abrams 4824; Summit, Dr. Eisen, July, 1891.

4. **Pentstemon procerus** Graham, Edinb. New Phil. Jour., vol. 7, p. 348. 1829.

P. confertus var. *caeruleo-purpureus* Gray, Proc. Am. Acad., vol. 6, p. 72. 1866.
P. confertus procerus Coville, Contr. Nat. Herb., vol. 4, p. 169. 1893.
P. pulchellus Greene, Pitt., vol. 3, p. 310. 1898.
P. glastifolius Greene, Leaflets, vol. 1, p. 162. 1906.
P. lassenianus Greene, *l.c.,* p. 164.

Type locality.—Not precisely given, but in what is now southern Washington.

Range.—Widely distributed in the Cordilleran section and westward, from Alaska and British Columbia southward.

Zone.—Transition and Canadian.

Specimens examined.—Silver Lake, Amador County, 8,000 feet, Hansen 453*; same locality, 7,200 feet, E. Mulliken 126 (with characters approaching the following variety); Angora Peak, Tahoe, 7,800 feet, Smiley 24; Suzy Lake trail, Tahoe, 7,300 feet, Smiley 170; ridge south of Donner Pass, 7,500 feet, Heller 7144; Yosemite Valley, Congdon, July 2, 1885; Nellie Lake, Fresno County, 8,700 feet, Smiley 609; Hockett's meadows, Tulare County, 8,500 feet, Hall and Babcock 5611.

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* This number has been seen on two sheets, all according to the label from Silver Lake, yet one of the sheets is distinctly of the tall low-mountain form with flowers in several verticils, the other is of the high-mountain form with flowers aggregated into a single terminal cluster; the next specimen (*Mulliken* 126) shows an intermediate condition between those states of this species presented by Hansen's collection. It is quite possible to arrange any large series of sheets of this plant in such a way as to show in convincing manner by what minute differences the intermediate forms pass from the tall lowland type to the depressed alpine state, and how impossible it is to define specific limits within the limits of the variations. In this connection, it is interesting to note the change of view

4a. **Pentstemon procerus f. geniculatus** (Greene), comb. nov.

P. geniculatus Greene, Pitt., vol. 3, p. 310. 1898.
P. cephalophorus Greene, Leaflets, vol. 1, p. 79. 1904.
P. chionophilus Greene, *l.c.*, p. 161. 1906.
P. interruptus Greene, *l.c.*, p. 163. 1906.

Type locality.—"Common on alpine slopes, below retreating snowbanks, in wet clayey or gravelly soil in the Sierra Nevada of California."

Range.—Sierra Nevada and mountains of Oregon, perhaps coextensive with the species.

Zone.—Hudsonian and Arctic-alpine, but appearing in the Canadian.

Specimens examined.—Mountains west of Summit, E. L. Greene in 1874; Castle Peak near the highest point, 9,000 feet, Heller 7095; Pyramid Peak, Tahoe, 9,600 feet, Hall and Chandler 4725; Desolation Valley, Tahoe, 8,500 feet, Smiley 338; Mt. Gibbs, Yosemite, Congdon, August 16, 1894; Mt. Dana, 11,000 feet, Hall and Babcock 3617; Mt. Brewer, Tulare County, grassy slopes, 10–13,000 feet, Purpus 1403; Summit Lake, Tulare County, Culbertson (B 4551).

This form connects with the species by numberless intermediates; in its typical form, the short slender stems bear terminal clusters of small deep blue flowers.

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as to the possibility of specific definition within this assemblage. In 1898, Dr. Aven Nelson defined *P. Rydbergii* (Bull. Torr. Bot. Club, vol. 25, p. 281) as a species amply distinct; in 1902 he similarly described *P. Owenii* (Bot. Gaz., vol. 34, p. 32); in 1909, the Coulter-Nelson New Manual was issued and these species are considered valid; but three years later (Bot. Gaz., vol. 54, pp. 145–146), the author of these propositions freely acknowledges the impossibility of maintaining them, consigning them to synonymy along with "a score (more or less) of Dr. Greene's species," which Professor Nelson appears to think so trivial as not to be worth mentioning by name. This wholesale rejection of previously accepted species is justified by the reflection that "Perhaps in no group of *Pentstemon* does a tendency to vary with every change in the ecological conditions manifest itself so fully as in *P. confertus* and its allies." It is quite probable that students of the western flora will very generally approve of Dr. Nelson's disposition of his species but they may regret that this recognition of the effect of the life-conditions upon a plant came too late to prevent unnecessary additions to the already redundant synonymy of this group of *Pentstemon*.

5. **Pentstemon heterodoxus** Gray, Syn. Fl., vol. 2, pt. 1, p. 269. 1886.

P. Fremontii Gray, Bot. Calif., vol. 1, p. 622. 1880.

Type locality.—"High mountain near Donner Pass, in the Sierra Nevada, California."

Range.—Tahoe region of the Sierra Nevada.

Zone.—Canadian?

Specimens examined.—Mt. Rose, 9,650 feet, Heller 9895; about Summit Station (Donner Pass), Heller 7007.

6. **Pentstemon glaber** Pursh., Fl., p. 738. 1814.

P. speciosus Dougl., *in* Lindl., Bot. Reg., vol. 15, pl. 1270. 1829.

Type locality.—"In Upper Louisiana."

Range.—South Dakota and Nebraska west to the Pacific Coast.

Zone.—Upper Sonoran to lower Canadian.

Specimens examined.—Fallen Leaf Lake, Tahoe, Miss Lathrop, July 23, 1909; lower end of Donner Lake, Heller 6920; Bonita meadow, Tulare County, 8,500 feet, Hall and Babcock 5202; Gold Lake, Plumas County, 6,400 feet, Hall and Babcock 4513; Angora Peak, Tahoe, 7,400 feet, Smiley 3; near Soda Springs, Nevada County, 7,200 feet, Smiley 459; Contact Pass, Mt. Rose, 8,500 feet, Kennedy 1268, with characters approaching var. *alpinus* Gray of the central Rocky Mountains.

6a. **Pentstemon glaber** var. **Wardii** Krautter, Contr. Bot. Lab. Univ. Pa., vol. 3, p. 120. 1908.

P. Wardii Gray, Proc. Am. Acad., vol. 12, p. 82. 1877.
P. Kingii var. *glauca* Kellogg, Proc. Calif. Acad., vol. 5, p. 39. 1873.

Type locality.—"Utah, near Glenwood, at 5,300 feet."

Range.—Great Basin ranges and eastern flank of the Sierra Nevada.

Zone.—Upper Sonoran, rising on dry rocky slopes to at least the Canadian.

Specimens examined.—Mt. Stanford (Castle Peak), Hooker and Gray in 1877; same locality, 8,600 feet, Smiley 482; Sierra Nevada, A. Kellogg, July 10, 1870.

The type locality for *P. Kingii* var. *glauca* is "Found near the summit of the Sierra Nevada Mts.," but the summit here referred to is the low crest near Summit Station, Nevada County.

7. **Pentstemon gracilentus** Gray, Pac. R.R. Rep., vol. 6, p. 82. 1857.

Type locality.—"At the base of Lassen's Butte, N. California." Newberry.

Range.—Mountains of southern Oregon through the Mt. Shasta region and the northern Sierra Nevada to the Tahoe district.

Zone.—Transition and lower Canadian.

Specimens examined.—Summit back of Jonesville, Butte County, 7,000 feet, Heller 11664; Independence Lake, Sierra County, 7,000 feet, Hall and Babcock 4528; Castle Peak, 8,000 feet, Smiley 465; Mt. Tallac, Tahoe, small meadow above Cathedral Park, 7,800 feet, Smiley 237; head of Fall Creek, Ormsby County, Nevada, 2,460 m., Baker 1326; summit of ridge near Marlette Peak, Washoe County, Nevada, 8,000 feet, Hall and Chandler 4566; Mt. Rose, in Contact Pass, 8,500 feet, Kennedy 1266.

This species is rather common in open glades in *Abies magnifica* forest.

8. **Pentstemon Roezli** Regel, Acta Hort. Petrop., vol. 2, p. 326. 1873.

Type locality.—"In Sierra Nevada in California." *Roezl.*

Range.—Mountains of southern Oregon to the Coast Range of California and through the Sierra Nevada to southeastern California.

Zone.—Transition and Canadian.

Specimens examined.—Cisco, on rocks, Miss H. A. Walker 1436, at 6,400 feet; above Hermit Valley, Alpine County, 8–8,500 feet, Hall and Chandler 4771; Silver Lake, Amador County, 7,200 feet, E. Mulliken 120.

9. **Pentstemon azureus** var. **parvulus** Gray, Syn. Fl., vol. 2, pt. 1, p. 272. 1878.

P. parvulus Krautter, Contr. Bot. Lab. Univ. Pa., vol. 3, p. 193. 1908.

Type locality.—"Northern part of California, in mountains above Jackson Lake, at 8,000 feet, *Greene.*"

Range.—Mountains of northern California to the southern Sierra Nevada.

Zone.—Canadian.

Specimens examined.—Soda Springs, Nevada County, M. E. Jones 2439; Summit, 7,000 feet, Smiley 441;* White Wolf, Yosemite, 7–8,000 feet, H. M. Evans, July, 1901; Alta meadows, Tulare County, Mrs. Brandegee, August 1–8, 1905; Alta Peak, Tulare County, 10,000 feet, G. B. Grant 1584.

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* Perhaps rather of the var. *angustissimus,* distinguished by leaves narrowly linear.

2. COLLINSIA

Calyx lobes acute, nearly as long as the short corolla .... 1. **C. parviflora**
Calyx lobes obtuse or obtusish, only ⅓ or ½ as long as the corolla.
  Corolla deep blue and uniformly colored .... 2. **C. Torreyi**
  Corolla with the upper lip yellowish .... 3. **C. Wrightii**

1. **Collinsia parviflora** Dougl., *in* Lindl., Bot. Reg., vol. 13, pl. 1082. 1827.

C. pauciflora Lindl., Hook., Fl. Bor. Am., vol. 2, p. 94. 1838.
''*Collinsonia*'' (sic!) *tenella* (Pursh) Piper, Contr. Nat. Herb., vol. 11, p. 496. 1906.

Type locality.—''In the vicinity of the river Columbia.''

Range.—British Columbia to the Great Lakes and south to New Mexico and California.

Zone.—Transition mainly, rising into the Canadian.

Specimens examined.—Lower end of Donner Lake, Heller 6867; Glen Alpine, Tahoe, Chesnut and Drew, August 10, 1890; Tioga Road near Aspen Valley, Yosemite, 6,400 feet, Smiley 911; Bonita meadow, Tulare County, 8,500 feet, Hall and Babcock 5186.

Collinsia brachysiphon Eastwood (Bull. Torr. Bot. Club, vol. 32, p. 214. 1905), described from plants ''Collected by the author at Summit, Placer County, California,'' is said to differ from *C. parviflora* Dougl. ''in leaves and inflorescence, and in color and shape of corolla.'' It is known to me only by description, from which it appears very doubtfully distinct from *C. parviflora.*

2. **Collinsia Torreyi** Gray, Proc. Am. Acad., vol. 7, p. 378. 1867.

C. inconspicua Congdon, Erythea, vol. 7, p. 186. 1900.

Type locality.—''Mariposa Big-tree Grove, and near Donner Lake.''

Range.—Southern Oregon to southern California.

Zone.—Transition and Canadian.

Specimens examined.—Soda Springs, Nevada County, M. E. Jones 2394; Cisco, S. Watson in 1867; above Donner Lake, Davy 3194; Half-Moon Lake, Tahoe, McGregor 72; Cloud's Rest trail, Yosemite, 7,800 feet, Smiley 504; Peregoy's, above Yosemite, A. Gray in 1872; near Hockett's meadows, Tulare County, Dudley 1899; Mt. Silliman region of Tulare County, along Clover Creek, Dudley 1467.

3. **Collinsia Wrightii** Wats., Proc. Am. Acad., vol. 24, p. 84. 1889.

Type locality.—"On the Greenhorn Mountains, Kern County, California, at 6,000 to 7,000 feet altitude."

Range.—Sierra Nevada.

Zone.—Transition mainly, rising into the Canadian.

Specimens examined.—Head of Fordyce Creek, Placer County, 6,910 feet, Hall 8724; Suzy Lake Basin, Tahoe, 7,600 feet, Smiley 144a; Tuolumne meadows, Yosemite, dry open pine forest, 8,600 feet, R. A. Ware 2615c, 2630c; same locality, in forest of *P. Murrayana*, 8,600 feet, Smiley 827; near Round meadow, Fresno County, 7,200 feet, dry gravelly soil, Smiley 582; trail to Farewell Gap from Mineral King, Tulare County, Coville and Funston 1566.

3. VERONICA

Inflorescence viscid pubescent; leaves obtuse; style ⅛ inch long.....1. **V. humifusa**
Inflorescence not viscid pubescent, but hairy; leaves acute; style much shorter, only about ⅓ as long as in No. 1......................2. **V. alpina** var. **unalaschensis**

1. **Veronica humifusa** Dickson, Trans. Linn. Soc., vol. 2, p. 288. 1794.

V. serpyllifolia var. *humifusa* Hook., Fl. Bor. Am., vol. 2, p. 101. 1838.

Type locality.—"Upon very high mountains, and under wet shady rocks" in Scotland.

Range.—In North America from the subarctic regions south to northern New England, New York; in the west, in the Rocky Mountains as far south as Colorado, and in the Cascade-Sierra axis, to California.

Zone.—Canadian mainly.

Specimens examined.—Suzy Lake, Tahoe, 7,600 feet, McGregor 121; Caple's Lakes, Alpine County, 8,500 feet, Hansen 547; Glen Alpine, Tahoe, 6,900 feet, Smiley 333; near Lily Lake, Tahoe, 6,600 feet, Smiley 297; Snow Valley, Ormsby County, Nevada, 2,460–2,615 m., Baker 1160; near Cloud's Rest, Yosemite, E. R. Drew, July 25, 1887; Tuolumne meadows, Yosemite, open grassy ground, 8,600 feet, R. A. Ware 2687c; Round meadow, Fresno County, 7,000 feet, Smiley 575; Volcano meadows (formerly called Whitney meadows), Tulare County, Hall and Babcock 5485.

2. **Veronica alpina** L. var. **unalaschensis** C. and S., Linnaea, vol. 2, p. 556. 1827.

V. Wormskjoldii R. and S., Syst., vol. 1, p. 101. 1817.

Type locality.—"Legimus in montosis insulae Unalaschka Aleutorum."

Range.—In North America, from Alaska to eastern Quebec, south to northern New England; in the west, along the Rocky Mountains to New Mexico, Arizona, and California.

Zone.—Canadian.

Specimens examined.—Ebbett's Pass, 8,500 feet, Brewer 2022, 2074; Tuolumne meadows, along the river, 8,500 feet, Smiley 751; same locality, open grassy ground, 8,600 feet, R. A. Ware 2635c; Red Mountain, Fresno County, 9,500 feet, Hall and Chandler, 455a; Crescent Lake, Mariposa County, Congdon, August 10, 1890; Mt. Silliman, Tulare County, Mrs. Brandegee, August, 1905; meadows near Farewell Gap, Tulare County, 10,400 feet, Purpus 5236; base of Mt. Whitney, Dudley 2480; head of the Tuolumne River, 9,000 feet, Brewer 1764.

4. ANTIRRHINUM

1. **Antirrhinum Kelloggii** Greene, Bull. Torr. Bot. Club, vol. 10, p. 126. 1883.

Type locality.—"Summit of the Sierra Nevada." Dr. Kellogg, July 20, 1870.

Range.—Central Sierra Nevada?

Zone.—Canadian or Transition.

Specimen examined.—Summit of the Sierra Nevada, Dr. A. Kellogg, July 20, 1870.

This species is referred to the synonymy of *A. Kingii* Wats. in the Syn. Fl., vol. 2, pt. 1, suppl., p. 439 (1886); this disposition I believe erroneous; its nearest ally is *A. strictum* Gray (Proc. Am. Acad., vol. 7, p. 375), from which it is not clearly distinguished. *A. strictum* is a Coast Range species of California. The chief points of difference from this latter species shown by *A. Kelloggii* are the larger leaves, which are flat, not revolute as common in the Coast Range species. Dr. Kellogg noted that it grew in patches by itself near snow banks; only additional material will determine if this is a valid species or merely an aberrent form.

5. MIMULUS

- Flowers pure yellow.
  - Calyx teeth unequal, the upper large and beak-like ......1. **M. nasutus**
  - Calyx teeth equal and equally divergent.
    - Flowers very long peduncled, solitary or few (not more than 3); leaves small (⅜ inch long) and entire ......2. **M. primuloides**
    - Flowers short or long peduncled in racemes, numerous– leaves larger ¾–2.5 inches long), usually dentate or deeply lobed.
      - Plants glabrous or essentially so.
        - Leaves pinnately parted ......3. **M. laciniatus**
        - Leaves dentate or serrate.
          - Rootstocks present ......4. **M. implexus**
          - Rootstocks wanting ......5. **M. Langsdorfii**
      - Plants pubescent.
        - Perennial plants; rootstocks with small moniliform tubers. ......6. **M. moniliformis**
        - Annual plants without rootstocks and with nearly sessile flowers ......7. **M. mephiticus**
- Flowers purple or pink (in *M. deflexus,* yellow flowers also occur).
  - Some of the pedicels at least twice as long as the calyx.
    - Plants tall (2–3 feet); flowers pink; perennial ......8. **M. Lewisii**
    - Plants small (2–8 inches high); annuals.
      - Corolla large, its tube at least twice as long as the calyx ......9. **M. filicaulis**
      - Corolla small, its tube no longer than the calyx ......10. **M. Breweri**
  - All of the pedicels very short or nearly obsolete.
    - Calyx teeth equally spreading.
      - Corolla with the purple throat blotched in stripes ......11. **M. Whitneyi**
      - Corolla with the throat uniformly colored ......12. **M. nanus**
    - Calyx teeth oblique ......13. **M. leptaleus**

1. **Mimulus nasutus** Greene, Bull. Calif. Acad., vol. 1, p. 112. 1885.

M. Langsdorfii var. *nasutus* (Greene) Jepson, Fl. N.W. Calif., ed. 1, p. 407. 1901.

Type locality.—"In Sonoma County, Calif., at Knight's Valley and Skaggs Springs."

Range.—Pacific Coast in the Cascade-Sierra Mountains and in the Coast Ranges. Also northern and western Idaho.

Zone.—Transition and Canadian.

Specimens examined.—Near Glen Alpine, Tahoe, 6,800 feet, Smiley 191; Cisco, Dr. Kellogg; Snow Creek, Yosemite, 7,200 feet, Smiley 670; marshy meadow near Aspen Valley, Yosemite, 6,400 feet, Smiley 912.

2. **Mimulus primuloides** Benth., Scroph. Ind., p. 29. 1835.

Type locality.—"Amer. boreali-occid." Douglas.

Range.—Pacific Coast from British Columbia to southern California.

Zone.—Upper Transition and Canadian.

Specimens examined.—Prattville, Plumas County, Heller and Kennedy 8783; Cisco, Miss H. A. Walker 1463; about Summit Station, Heller 6972; Snow Valley, Ormsby County, Nevada, 2,460–2,615 m., Baker 1277; Tuolumne meadows, open pine forest, 8,600 feet, R. A. Ware 2632c; Lake of the Woods meadow, Tahoe, 8,200 feet, Smiley 68; Cloud's Rest trail, Yosemite, 7,900 feet, Smiley 503; Tuolumne meadows, 8,500 feet, Smiley 744; Billy Brown's meadow, Shuteye Mountain, Madera County, 6,500 feet, J. Murdoch Jr. 2580; Peckinpah's Mill, above Northfork, Madera County, 6,300 feet, Smiley 551; Hockett's meadows, Tulare County, very abundant on the meadows, Dudley 1887; Mineral King, Tulare County, Coville and Funston 1474.

2a. **Mimulus primuloides** var. **pilosellus** (Greene), comb. nov.

M. pilosellus Greene, Erythea, vol. 4, p. 22. 1896.

Type locality.—Not given.

Range.—Same as the species.

Zone.—Canadian and Hudsonian.

Specimens examined.—Meadow near Angora Lake, Tahoe, 7,300 feet, Hall and Chandler 4645; Silver Lake, Amador County, Hansen 462; Glen Alpine, Tahoe, McGregor 18; Mt. Rose, 10,000 feet, Kennedy 1178; Upper Tuolumne River, 9,000 feet, Brewer 1755; Elizabeth Lake meadow, Yosemite, 9,800 feet, Smiley 804; Funston's meadows, Tulare County, Dudley 2194 in part, the other part being of the type form.

This form of *M. primuloides* is distinguished from the species by smaller flowers, and smaller leaves, which are covered with white villous hairs. Dr. Greene indicated its relation to the species some ten years before he proposed it as distinct: in Bull. Calif. Acad., vol. 1, p. 120, the statement is made: "The white-villous form is rare in collections, and when growing with the other, looks like another species, but in floral character, there is no difference between them." The species and variety frequently grow together.

3. **Mimulus laciniatus** Gray, Proc. Am. Acad., vol. 11, p. 98. 1876.

Type locality.—"California, on the South Fork of the Merced at Clark's Ranch."

Range.—Central and southern Sierra Nevada.

Zone.—Transition and Canadian.

Specimens examined.—Near Snow Flat, Yosemite, H. M. Evans, July, 1901; Alta Mountains, Tulare County, R. Hopping 208.

4. **Mimulus implexus** Greene, Lond. Jour. Bot., vol. 33, p. 8. 1895.

M. Tilingi Greene, Bull. Calif. Acad., vol. 1, p. 110. 1885.
M. corallinus Greene, Erythea, vol. 4, p. 21. 1896, not of Regel.

Type locality.—"Along streams in the higher Sierras, from Lassen's Peak northward and southward."

Range.—Washington to California; also in the East Humboldt Mountains, Nevada, acc. Kennedy, Muhl., vol. 8, pp. 18–19. 1912.

Zone.—Canadian and Hudsonian.

Specimens examined.—Summit Station, E. L. Greene, August, 1883; near Mt. Stanford (Castle Peak), wet places under bushes, Sonne, July, 1895; below Suzy Lake, Tahoe, moist stream bank, 7,500 feet, Smiley 157; Silver Mountain, Alpine County, Hooker and Gray in 1877; branch of White's Creek, Washoe County, Nevada, 8,500 feet, Kennedy 1886; divide south of Slide Mountain, Washoe County, 7,600 feet, Heller 10922; along Coldstream, 3 miles above Truckee, Heller 7004; ridge above Donner Pass, 7,500 feet, Heller 7137; Independence Lake, Nevada County, 7,000 feet, Hall and Babcock 4530; base of Mt. Dana, Chesnut and Drew, July 17, 1889; Mt. Goddard, 11,100 feet, Hall and Chandler 692; moist shady ravine near White Wolf, Yosemite, 8,000 feet, Smiley 887; by brooks near Farewell Gap, Tulare County, 10,300 feet, Purpus 5243; Mt. Whitney, Culbertson (B 4544); same locality, 12,000 feet, Hall and Babcock 5541; Alta Mountains, Tulare County, R. Hopping 214; cold streams on Mt. Silliman, 10,000 feet, Mrs. Brandegee, August 22, 1905; slopes of Sawtooth Peak, Tulare County, 11–12,000 feet, Dudley 1607.

The characters relied upon in considerable part to separate *M. implexus* from *M. corallinus* are leaf characters, but the descriptions of the leaves of *M. implexus,* as given by Dr. Greene, leave one in some perplexity. In the publication of *M. implexus,* its characters are briefly indicated from the original description (as *M. Tilingi*), and it is further noted that "No other member of the group makes any approach to it, either in this character or in that of the exceedingly thin membranaceous texture of the leaves." A year later, in a note subjoined to the description of *M. corallinus,* the leaves of *M. implexus* are asserted to be "of unusual thickness and fleshiness of texture."

5. **Mimulus Langsdorffi** Donn, *in* Sims, Bot. Mag., pl. 1501. 1812.

M. guttatus DC., Cat. Monsp., p. 127. 1813.
M. minor A. Nels., Proc. Biol. Soc. Wash., vol. 17, p. 178. 1904.
M. puberulus Greene, *in* Rydb., Fl. Col., p. 311. 1906; Leaflets, vol. 2, p. 4. 1909.
M. minusculus Greene, *l.c.*, p. 5.

Type locality.—"From Unashka, one of the Fox Islands." (= Unalaska.)

Range.—Aleutian Islands to California, Colorado and New Mexico.

Zone.—Transition to Hudsonian.

Specimens examined.—Donner Lake, Brandegee, September, 1888; Half-Moon Lake, Tahoe, 7,780 feet, McGregor 68; Upper Tuolumne River, 9,000 feet, Brewer 1754; above Kokopo Creek, Kaweah Peaks, Tulare County, Dudley 2438; South Fork of Kern River, 8,200 feet, Rothrock 312; near Farewell Gap, Tulare County, 10,000 feet, Dudley 2598.

At the highest altitudes, this species becomes dwarfed and the leaves crowded, but it seems impracticable to maintain, at least with respect to the Sierran material, this high mountain form as a variety with assignable characters.

6. **Mimulus moniliformis** Greene, Bull. Cal. Acad., vol. 1, p. 10. 1884.

Type locality.—Not precisely given, only as "In the higher Sierras."

Range.—Northern California (Mt. Shasta) southward through the Sierra Nevada.

Zone.—Canadian.

Specimens examined.—Donner Lake, E. L. Greene 469; Soda Springs, Nevada County, Jones 2608; Summit, Mrs. Brandegee, July, 1908; Snow Creek, Yosemite, 6,800 feet, Hall 9186; new Tenaya trail, Yosemite, Miss H. Geiss 9072; Glacier Point, Miss Camp, July, 1902.

7. **Mimulus mephiticus** Greene, Bull. Calif. Acad., vol. 1, p. 9. 1884.

Eunanus mephiticus Greene, *l.c.*, p. 102. 1885.

Type locality.—"Collected on Cloud's Rest, Yosemite."

Range.—Central and southern Sierra Nevada.

Zone.—Canadian and rarely in the Hudsonian.

Specimens examined.—Cloud's Rest, eastern ridge, 9,500 feet, Smiley 516; summit of Cloud's Rest, 9,925 feet, Hall 9052; Hockett's meadows, Tulare County, 8,500 feet, Hall and Babcock 5622.

8. **Mimulus Lewisii** Pursh., Fl., vol. 2, p. 427, pl. 20. 1814.

M. roseus Dougl., *in* Lindl., Bot. Reg., vol. 19, pl. 1591. 1833.

Type locality.—"On the head springs of the Missouri at the foot of Portage hill."

Range.—British Columbia to California and along the Rocky Mountains to Colorado.

Zone.—Transition and Canadian.

Specimens examined.—Summit Soda Springs, Nevada County, Kennedy 269; ridge above Donner Pass, 7,500 feet, Heller 7141; Lake of the Woods, Tahoe, 7,850 feet, McGregor 40; Pyramid Peak, Tahoe, east side at 8,900 feet, Smiley 119; ridge south of Heather Lake, Tahoe, 8,300 feet, Smiley 355; Hope Valley, Alpine County, 8,500 feet, Hansen 471; Bloody Cañon, Mono County, 9,000 feet, R. A. Ware 2610c; Mono Pass, Bolander 6315; Ebbett's Pass, Alpine County, 8,000 feet, Brewer 1980; near Snow Flat, Yosemite, 8,700 feet, H. M. Evans, July, 1901; Mariposa County, Congdon, August 12, 1895; Mt. Raymond, Madera County, 8,300 feet, Smiley 542; Alta meadows, Tulare County, 9,000 feet, Mrs. Brandegee, August 4, 1905.

9. **Mimulus filicaulis** Wats., Proc. Am. Acad., vol. 26, p. 125. 1891.

Type locality.—"Collected by J. W. Congdon on Snow Creek, Mariposa County, California, in June, 1890."

Range.—Central Sierra Nevada.

Zone.—Canadian?

Specimen examined.—Snow Creek, Mariposa County, Congdon, June 1, 1890.

Doubtfully distinct from *M. Palmeri* Gray (Proc. Am. Acad., vol. 12, p. 82), a common species of the Yellow Pine belt on the west flank of the Sierra.

10. **Mimulus Breweri** (Greene) Coville, Contr. Nat. Herb., vol. 4, p. 171. 1893.

Eunanus Breweri Greene, Bull. Calif. Acad., vol. 1, p. 101. 1885.

Type locality.—"Common about Donner Lake, growing with *E. leptaleus,* to which it is most related."

Range.—Pacific Coast from British Columbia to southern California; at the north, east to Montana.

Zone.—Transition and Canadian.

Specimens examined.—Lower end of Donner Lake, Heller 6893; Silver Lake, Amador County, 8,000 feet, Hansen 441; Suzy Lake basin, Tahoe, dry ground on south slope, 7,500 feet, Smiley 172; Lake Valley, Tahoe region, 6,400 feet, Abrams 4780; Tuolume meadows, Yosemite, dry rocky ground about Parsons Lodge, 8,500 feet, Smiley 746; Home Camp meadow, Fresno County, 6,900 feet, Smiley 654; Alta meadows, Tulare County, Mrs. Brandegee, August 6, 1905; Kern-Kaweah Falls, Tulare County, 10,000 feet, Dudley 2364.

11. **Mimulus Whitneyi** Gray, Syn. Fl., vol. 2, pt. 1, p. 445. 1886.

Eunanus bicolor Gray, Proc. Am. Acad., vol. 7, p. 381. 1867.
Mimulus nanus var. *bicolor* Gray, Syn. Fl., vol. 2, pt. 1, 275. 1878.

Type locality.—"In the Sierras between King's and Kawiah Rivers, *Prof. Brewer.*"

Range.—Southern Sierra Nevada.

Zone.—Canadian and Hudsonian.

Specimens examined.—High Sierras, Fresno County, Brewer 2785; Alta meadows, Tulare County, 9,000 feet, K. Brandegee, August, 1905; Mt. Silliman, 10,000 feet, K. Brandegee, August 22, 1905; Horse Corral meadows, Fresno County, Eastwood, July 1–13, 1889; open woods near Old Mt. Whitney, 10–11,000 feet, Purpus 1988 and 1989; sandy places, Whitney meadows, 9–11,000 feet, Purpus 1372.

12. **Mimulus nanus** H. and A., Bot. Beechy, p. 378. 1840.

M. coccineus Congdon, Erythea, vol. 7, p. 187. 1900.
M. Tolmei Benth., *in* DC., Prodr., vol. 10, p. 374. 1846.

Type locality.—Not given, but the plant described collected in California.

Range.—Pacific Coast from Washington to California, east to Montana and Wyoming.

Zone.—Upper Sonoran to Canadian.

Specimens examined.—Mt. Rose, 9,500 feet, Heller 10343; north side of Slide Mountain, Washoe County, 7,700 feet, Heller 10950; Snow Valley, Ormsby County, Nevada, 2,460–2,615 m., Baker 1375; volcanic hills south of Mono Lake, in very dry sand from the plains to the summit, 9,000 feet, Brewer 1821; Mt. Dana, H. M. Evans, July, 1901; Crescent Lake, Mariposa County, Congdon, August 9, 1890; mountain sides east of the Minarets, Mariposa County, Congdon, August 19, 1899; slope above Nellie Lake, Fresno County, 9,000 feet, Smiley 614; Kaweah meadows, Tulare County, 9,400 feet, Purpus 5650; north side of Toowa Range, Tulare County, 9,000 feet, H. M. and G. R. Hall 8414; gravelly soil on Shotgun Creek, Tulare County, 10–11,000 feet, Purpus 5245; Kern River, 9,850 feet, Rothrock 378.

13. **Mimulus leptaleus** Gray, Proc. Am. Acad., vol. 11, p. 96. 1875.

Type locality.—"Gravelly soil, in the Sierra Nevada, California, at 5,000 feet and upwards, south of the Yosemite, *Miss Dix, A. Gray,* and in Sierra County, *Lemmon.*"

Range.—Sierra Nevada.

Zone.—Transition and lower Canadian (*Pinus Jeffreyi* belt).

Specimens examined.—Mt. Tallac, Tahoe, 9,500 feet, McGregor 191; Soda Springs, Nevada County, Jones 2459; east side of Angora Peak, Tahoe, 7,800 feet, Smiley 28; hillside above Summit, 7,100 feet, Smiley 451; near Castle Peak, Heller 7067; between Donner and Cisco, Mrs. Brandegee, July, 1908; North Fork of King's River, 7,000 feet, Hall and Chandler 429; Whitney meadows (now called Volcano meadows), Tulare County, 2,850 m., Coville and Funston 1625.

Though this is as a rule pungently scented, it may be practically odorless.

Mimulus montioides Gray (Proc. Am. Acad., vol. 7, p. 380. 1867), described from "High Sierras of Fresno Co., *Prof. Brewer,*" is only known from the Upper Sonoran and Arid Transition life-zones; it is probable that the type described really came from the low country east of the Sierra; this conjecture is based partly upon the fact that the type preserved in the Gray Herbarium bears the legend "2785, with," suggesting accidental association of the plant described with this number of the State Survey. In the field book of the Survey, the numbers from 2781–2844 are from the mountains of Tulare County, in the vicinity of Mt. Brewer.

6. PEDICULARIS

- Plants acaulescent; spikes shorter than the leaves; flowers yellowish and purplish .... 1. **P. semibarbata**
- Plants caulescent; spikes exceeding the leaves.
  - Flowers white; galea circinnate-incurving .... 2. **P. racemosa**
  - Flowers red or purple; galea sigmoid-curving.
    - Spike glabrous .... 3. **P. groenlandica**
    - Spike lanate-pubescent .... 4. **P. attolens**

1. **Pedicularis semibarbata** Gray, Proc. Am. Acad., vol. 7, p. 385. 1867.

Type locality.—"On Mount Dana, alt. 10,000 feet, and Ebbett's Pass, 7–8,000 feet, *Prof. Brewer.* In or near the Yosemite Valley, *Bolander,* and Mariposa Grove, at and above 5,000 feet."

Range.—Southern Oregon and mountains of northern California, south in the Coast Range, and in the Sierra Nevada to the mountains of southern California.

Zone.—Transition and Canadian.

Specimens examined.—Above Donner Lake, Davy 3180; about Summit Station, Heller, July 20, 1903; Snow Valley, Ormsby County, Nevada, 2,460–2,615 m., Baker 1158; divide on south side of Slide Mountain, Washoe County, Nevada, 7,600 feet, Heller 10924; shoulder of Ralston Peak, Tahoe, Setchell and Dobie, July 6–21, 1901; Silver Lake, Amador County, 8,000 feet, Hansen 436; Glen Alpine, Tahoe, 6,800 feet, McGregor 200; Ebbett's Pass, open forests at 7–8,000 feet, Brewer 2707; Mt. Dana, 10,000 feet, Brewer 1741; Mt. Raymond, Madera County, 7,500 feet, Smiley 529; Hockett meadows, Tulare County, Culbertson (B 4430); Sequoia Mills, Fresno County, Miss Eastwood, May, 1894.

2. **Pedicularis racemosa** Dougl., *in* Hook., Fl. Bor. Am., vol. 2, p. 108. 1838.

Type locality.—"Abundant on the summit of the high mountains of the Grand Rapids of the Columbia." Douglas.

Range.—British Columbia to California (northern Sierra Nevada) and in the Cordilleran section to New Mexico.

Zone.—Canadian.

Specimens examined.—Spanish Peak, Plumas County, Mrs. R. M. Austin in 1879; Sierra County, Lemmon in 1874; Placer County, A. M. Carpenter, September, 1892; trail to Mud Lake, Cisco, 6,000 feet, Miss H. A. Walker 1502.

3. **Pedicularis groenlandica** Retz., Fl. Scand. Prodr., ed. 2, p. 145. 1795.

Elephantella groenlandica (Retz.) Rydb., Mem. N. Y. Bot. Gard., vol. 1, p. 360. 1900.

Pedicularis groenlandica surrecta (Benth.) Piper, Mazama, vol. 2, p. 100. 1901.

Type locality.—Greenland.

Range.—Labrador to Alaska; south along the Rocky Mountains to New Mexico; in the Cascades—Sierra Nevada to California. Greenland.

Zone.—Canadian mainly, but occurring in the Hudsonian.

Specimens examined.—About Summit Station, Heller 7009; Deer Park, Tahoe, A. Eastwood 433; summit of Mono Pass, 10,800 feet, Brewer 1718; Lake Tanaya, 8,100 feet, Smiley 681; Rowell meadow, Fresno County, Dudley, August 23, 1904; Wet meadows near Farewell Gap, Tulare County, 10,400 feet, Purpus 5181; Olancha Mountain, Tulare County, 8,500 feet, Hall and Babcock 5281; meadows near Mineral King, Tulare County, Dudley 2612; Dana Creek, 10,300 feet, Hall and Babcock 3621.

4. **Pedicularis attolens** Gray, Proc. Am. Acad., vol. 7, p. 384. 1867.

Elephantella attolens (Gray) Heller, Muhl., vol. 1, p. 4. 1900.

Type locality.—"Swamps in the Sierra Nevada, alt. 6–11,000 feet."

Range.—Sierra Nevada. Mountains of northern California?

Zone.—Canadian.

Specimens examined.—Prattville, Plumas County, Mrs. A. L. Coombs, July 7, 1902; lower end of Donner Lake, Heller 6938; Mt. Rose, 9,650 feet, Heller 9897; same locality, 10,000 feet, Kennedy 992; Silver Lake, Amador County, 7,200 feet, E. Mulliken 123; Half-Moon Lake, Tahoe, 7,780 feet, McGregor 81; Pyramid Peak, 9,500 feet, Smiley 124; Suzy Lake basin, Tahoe, 7,600 feet, Smiley 146; Lake of the Woods meadow, Tahoe, 8,100 feet, Smiley 73; Silver Mountain Pass, Alpine County, Brewer 2708; Mt. Dana, 13,000 feet, Lemmon, August 22, 1878; Crescent Lake, Mariposa County, Congdon, August 14, 1895; Mono trail, 10,000 feet, Bolander 5097; Westfall's meadows, above Yosemite, Bolander 4963; Bloody Cañon, Mono County, 8,500 feet, R. A. Ware 2645c; San Joaquin River, Fresno County, Coville and Funston 1835; meadows on Black Mountain, Fresno County, 10,000 feet, Hall and Chandler 594; Alta Mountain, Tulare County, R. Hopping 70; wet meadows near Farewell Gap, Tulare County, 10,400–11,000 feet, Purpus 5656; Funston's meadows, Tulare County, 8–9,000 feet, Dudley 2190; Hockett's meadows, Tulare County, 8,500 feet, Hall and Babcock 5620.

7. CASTILLEJA

Flowers red (*C. miniata* sometimes is found with yellowish flowers but is known from *C. nana* by the undivided leaves).
  Plants low (less than 1 foot high); galea shorter than the tube.
    Galea ⅛ inch long; the lower lip somewhat saccate ....1. **C. Lemmoni**
    Galea ¼–⅜ inch long; the lower lip not saccate.
      Leaves mostly entire, linear-lanceolate; flowers crimson 2. **C. Culbertsonii**
      Leaves entire below, 3-lobed above; broader than in No. 2; flowers dull red ....3. **C. Breweri**
  Plants taller (1–4 feet); galea as long or longer than the tube.
    Plants green and nearly glabrous; galea exceeding the tube.
      Floral cluster of distinctly uneven outline due to the divaricate galeas; flowers red ....4. **C. montana**
      Floral cluster globose or bunched, due to the bracts and galeas remaining subequal and approximate; flowers red or yellow ....5. **C. miniata**
    Plants pilose, often white-lanate; galea and tube subequal.
      Leaves lobed ....6. **C. angustifolia**
      Leaves entire or nearly so ....7. **C. pinetorum**
Flowers yellow or ochroleucous ....8. **C. nana**

1. **Castilleja Lemmoni** Gray, Syn. Fl., vol. 2, pt. 1, p. 297. 1878.

Type locality.—"Sierra Co., California, probably in the alpine region."

Range.—Sierra Nevada from Sierra County to the Mt. Whitney region.

Zone.—Canadian.

Specimens examined.—Sierra County, Lemmon 736; wet grassy flat on Mt. Stanford, 8,000 feet, C. F. Sonne 9; Hockett's meadows, Tulare County, 8,600 feet, Hall and Babcock 5637; same locality, Culbertson (B 4424).

This appears to be a rare species in the Sierra and some forms of the following species closely approach it, though the characters assigned in the key usually serve for specific reference.

2. **Castilleja Culbertsonii** Greene, Leaflets., vol. 1, p. 78. 1904.

Type locality.—"Crabtree meadow, at 11,000 feet, near Mt. Whitney."

Range.—Southern Sierra Nevada.

Zone.—Hudsonian mainly, rarely in the Canadian.

Specimens examined.—Cathedral trail, Mariposa County, Congdon, August 7, 1898; Mt. Dana, Congdon, August 27, 1895; Mt. Buena Vista, Yosemite, 9,000 feet, Congdon, August 23, 1889; Tuolumne meadows, Yosemite, 8,500 feet, Smiley 831; Sierras, 10,000 feet, Bolander 6309; meadows near Black Mountain, Fresno County, 10,000 feet, Hall and Chandler 588; Crabtree meadows, Tulare County, 11,000 feet, Culbertson (B 4339); Kaweah meadows, Tulare County, 9,400 feet, Purpus 5134; Mt. Whitney, Edw. Hyatt; Whitney Creek near timber line, 10,500 feet, Hall and Babcock 5551.

3. **Castilleja Breweri** Fernald, Erythea, vol. 6, p. 49. 1898.

Type locality.—"On Mt. Dana, California, at 3,060 to 3,360 m."

Range.—Central Sierra Nevada.

Zone.—Hudsonian and Arctic-alpine.

Specimens examined.—Mt. Dana, 10–11,000 feet, Brewer 1744; same locality, in rocks above the saddle, Chesnut and Drew, July 17, 1889; Hopkins meadow near Cloud's Rest, Chesnut and Drew, July 13, 1889; slopes east of the Minarets, Mariposa County, Congdon, August 18, 1899.

4. **Castilleja montana** Congdon, Erythea, vol. 7, p. 188. 1900.

Type locality.—Not definitely given.

Range.—Sierra Nevada, east in the mountains of Nevada (West Humboldt Mountains).

Zone.—Canadian and Transition.

Specimens examined.—Summit back of Jonesville, Butte County, 7,000 feet, Heller 11658; lower end of Donner Lake, Heller 6881; Grass Lake, Tahoe, McGregor 9; Suzy Lake basin, Tahoe, 7,800 feet, Smiley 171; Caple's Lakes, Alpine County, 8,500 feet, Hansen 892; Fallen Leaf Lodge, Tahoe, 6,900 feet, Abrams 4869; Mt. Rose, 9,650 feet, Heller 9900; Lake Tenaya trail, foot of Mt. Dana, Congdon, August 14–16, 1894; Crescent Lake, Congdon, August 14–15, 1895; Tuolumne meadows, 8,500 feet, Smiley 708; Little Kern River, Tulare County, along brooks, 9–10,000 feet, Purpus 5223; Olancha Mountain, Tulare County, 10,000 feet, Rothrock 333.

This species about Lake Tahoe and northward shows forms closely approaching the next and perhaps, when more material is available for comparison collected in the northern Sierra, it will be best considered as a variety of *C. miniata*. *Hall* 2582, from Tahquitz Valley, San Jacinto Mountains, is probably to be assigned to *C. montana*, a reference which would extend the range to the mountains of southern California.

5. **Castilleja miniata** Dougl., *in* Hook., Fl. Bor. Am., vol. 2, p. 106. 1838.

C. Brooksii Eastwood, Proc. Calif. Acad. III, vol. 2, p. 288. 1902.

Type locality.—"Blue Mountains, N.W. America."

Range.—Alaska to California and Colorado.

Zone.—Transition and Canadian.

Specimens examined.—Summit, 6,800 feet, Heller 10590; Webber Lake, Kennedy and Doten 93; trail to Suzy Lake basin, Tahoe, in marshy meadow, 7,600 feet, Smiley 277*; Pyramid Peak, Tahoe, 9,500 feet, Smiley 106; Snow Valley, Ormsby County, Nevada, 2,460–2,615 m., Baker 1484.

As noted under the preceding species, in the Tahoe region plants occur which are very difficult of satisfactory assignment, the characters they present allying them on the one hand to the present species, and yet showing obvious resemblances to *C. montana*. At the present time, about all one is justified in asserting, is that in *C. miniata* we have a plant of definitely northern and eastern distribution, which in the Sierra shows at least one well-marked variant, here provisionally accepted as a species.

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* *C. miniata* occasionally shows yellow bracts and flowers; it is not known whether this color form persists as a race or not; in every other respect these yellow-flowered plants are precisely like the usual red flowered kind.

6. **Castilleja angustifolia** G. Don var. **hispida** (Benth.) Fernald, Erythea, vol. 6, p. 47. 1898.

C. hispida Benth., *in* Hook, Fl. Bor. Am., vol. 2, p. 105. 1838.

Type locality.—"Common on dry soils of the N.W. Coast, especially about Port Vancouver."

Range.—Washington to California and in the mountains through Idaho and Wyoming to Colorado.

Zone.—Transition and above.

Specimens examined.—Lake Valley, Tahoe region, 6,400 feet, Abrams 4768; Mt. Rose, 9,300 feet, Heller 10348; Cisco, Placer County, 5,900 feet, Hall 8707; Silver Lake, Amador County, 7,200 feet, E. Muliken 146; vicinity of Lake Tenaya, Yosemite, 8,200 feet, Hall and Babcock 3525; Mt. Guyot, 11,000 feet, H. M. and G. R. Hall 8427.

7. **Castilleja pinetorum** Fernald, Erythea, vol. 6, p. 50. 1898.

C. trisecta Greene, Leaflets, vol. 1, p. 78. 1904.

Type locality.—"In pine woods, Swan Lake Valley, Klamath Co., Oregon."

Range.—Oregon and southwestern Idaho to California and Nevada.

Zone.—Arid Transition to Canadian.

Specimens examined.—Mt. Dana, Congdon, August 11, 1898; Hockett's meadows, Tulare County, 8,600 feet, rather dry soil, Hall and Babcock 5608; same locality, Culbertson (B 4431); South Fork of the Kaweah, Tulare County, 9,000 feet, H. M. and G. R. Hall 8476; Lake Tenaya, Yosemite, 8,200 feet, Smiley 678.

This species is quite common in the dry Murray Pine forests. The leaf variant (*C. trisecta*) is incapable of definition, merging into the species in all characters.

8. **Castilleja nana** Eastwood, Proc. Calif. Acad. III, vol. 2, p. 289. 1902.

C. inconspicua A. Nels. and Kennedy, Proc. Biol. Soc. Wash., vol. 19, p. 38. 1906.

C. ambigua Jones, Contr. W. Coast Bot., vol. 12, p. 68. 1908.

Type locality.—"On Harrison's Pass, above East Lake," Fresno County.

Range.—Sierra Nevada from King's River region northward to Mt. Shasta.

Zone.—Arctic-alpine, and on rockslides in the Hudsonian.

Specimens examined.—Cisco, Bolander in 1871–72; near Donner Lake, Torrey 363; near Frog Lake, Castle Peak, Heller 7064; Gold Lake, Sierra County, 6,400 feet, Hall and Babcock 4512; above Summit, Placer County, C. F. Sonne, June, 1897; Mt. Rose, 10,800 feet, Kennedy 1169; Mount Hoffman, Yosemite, A. Eastwood, July 5–19, 1902; Mt. Dana, Congdon, August 10, 1898; high southern Sierra, Brewer 2838; Mt. Goddard, 11,100 feet, Hall and Chandler 689; Desolation Valley, base of Pyramid Peak, Tahoe, 8,400 feet, Smiley 89; rocky places in Farewell Gap, Tulare County, 10,300 feet, Purpus 5256, 3004; Mineral King, T. S. Brandegee, July 29, 1892.

8. ORTHOCARPUS

1. **Orthocarpus imbricatus** Torr., *in* Watson, Bot. King's Exped., p. 458. 1871.

O. cuspidatus Greene, Pitt., vol. 4, p. 101. 1899.
O. Copelandii Eastwood, Bot. Gaz., vol. 41, p. 288. 1906.
O. cryptanthus Piper, Smithson. Misc. Coll., vol. 50, p. 200. 1907.

Type locality.—"In the Cascade Mts., Oregon."

Range.—Pacific Coast from Washington to California.

Zone.—Transition and Canadian.

Specimens examined.—Hills above Red Clover Valley, Plumas County, Heller and Kennedy 8700; lower end of Donner Lake, Heller 6884; Summit, T. S. Brandegee, August, 1883; Caples Lakes, Alpine County, 8,500 feet, Hansen 455; near Lundy, Mono County, 8–9,000 feet, Miss M. Minthorn, July 15, 1908; Piute Creek, Yosemite, 8,200 feet, F. M. Reed 3462; Mariposa County, Congdon, August 20, 1894.

Orthocarpus pilosus Wats. (Bot. King's Exped., p. 231. 1871), described from "Washoe Valley, Nevada," and a widely distributed Upper Sonoran and Arid Transition species, just reaches our lower borders (Sonora trail, east side of summit at 8,000 feet, Brewer 1866; above Grass Lake, Tahoe, 7,000 feet, Miss Lathrop, July 19, 1909).

53. RUBIACEAE (Madder Family)

1. GALIUM

Fruit smooth .... 1. **G. Brandegei**
Fruit hispidulous or bristly.
  Small delicate annual (2–6 inches high); hairs of the fruit minute .... 2. **G. bifolium**
  Perennial with suffrutescent base; hairs of the bristly fruit longer than the body .... 3. **G. multiflorum**

1. **Galium Brandegei** Gray, Proc. Am. Acad., vol. 12, p. 58. 1877.

Type locality.—"Valley of the Rio Grande, New Mexico, on Los Pinos trail, at 9,000 feet, September, 1875, *T. S. Brandegee.*" (On a sheet of the original collection, now in the herbarium at Berkeley, California, it is stated that the locality of the collection was in Colorado, not in New Mexico, as given by Dr. Gray.)

Range.—California to Colorado and northward in the Rockies to Saskatchewan.

Zone.—Transition and Canadian.

Specimens examined.—Webber Lake, Lemmon 1217; Suzy Lake, Tahoe, forming small mats near the water, 7,800 feet, Smiley 151; about Marlette Lake, Washoe County, Nevada, Baker 1412; Ostrander's, above Yosemite, Bolander 5025.

2. **Galium bifolium** Wats., Bot. King's Exped., p. 134. 1871.

Type locality.—"In the Trinity, Battle and East Humboldt Mountains, Nevada, and in the Wahsatch; 5–7,000 feet altitude." Watson 480.

Range.—California to British Columbia, east to Colorado and Wyoming.

Zone.—Canadian.

Specimens examined.—Sierra County, Lemmon 548; above Donner Lake toward Donner Pass, Heller, July 29, 1903; Glen Alpine, Tahoe, 7,000 feet, McGregor 151; Lake Lucile, Tahoe, Dudley, June 26, 1900; Mt. Tallac, west slope above Gilmore Lake, 8,400 feet, Smiley 372; near Stewart Edward White meadow, Sierra National Forest, Abrams 4988; Lake Tenaya, meadow south of the lake, 8,200 feet, Smiley 863a; North Fork of King's River, 7,300 feet, Hall and Chandler 452.

3. **Galium multiflorum** Kellogg, Proc. Calif. Acad., vol. 2, p. 97. 1861.

G. hypotrichum Gray, Proc. Am. Acad., vol. 6, p. 538. 1866.
G. ambiguum Wight, Zoe, vol. 5, p. 55. 1900.

Type locality.—''Washoe,'' Nevada. Dr. J. A. Veatch.

Range.—California to Washington and east to Utah.

Zone.—Canadian mainly.

Specimens examined.—Castle Peak, near the highest point, Heller 7080; high mountain near Donner Pass, Torrey 187; Tinker's Knob, Placer County, C. F. Sonne, August 27, 1893; Summit, 8,000 feet, Bolander and Kellogg; Sonora Pass, 8–9,000 feet, Brewer 1880.

Wherein *G. multiflorum puberulum,* a subspecies briefly defined by Piper (Contr. Nat. Herb., vol. 11, 527. 1906), differs from typical *G. multiflorum* is not clear.

Miss Eastwood reports[89] *G. multiflorum* from East Lake, in the high Sierra of Tulare County. It was also collected by Hall in the San Jacinto Mountains[79] in the upper Transition life-zone.

54. LENTIBULARIACEAE (Bladderwort Family)

1. UTRICULARIA

1. **Utricularia vulgaris** L., Sp. Pl., p. 18. 1753.

Type locality.—''Habitat in Europae fossis palidibus profundioribus.''

Range.—Eurasia. In North America from Alaska to California and New Mexico.

Zone.—Transition and Canadian.

Specimens examined.—Head of Lake Tahoe, 6,400 feet, Brewer 2147; Plumas County, Lemmon in 1874; in pool near soda springs, Tuolumne Meadows, 9,700 feet, Bolander 6382; ponds in Kaweah meadows, Tulare County, 9,300 feet, Purpus 5680.

Our plants perhaps better referred to the var. *americana* Gray, distinguished from the Old World species by the spur acutish and more slender.

55. CAPRIFOLIACEAE (Honeysuckle Family)

Leaves pinnately compound; inflorescence a many-flowered cyme ....1. **Sambucus**
Leaves simple; inflorescence few-flowered.
  Corolla regular; fruit 2-seeded ....2. **Symphoricarpus**
  Corolla irregular; fruit few to several seeded ....3. **Lonicera**

1. SAMBUCUS

Berries red ....1. **S. racemosa**
Berries black or very dark red ....2. **S. melanocarpa**

1. **Sambucus racemosa** L., Sp. Pl., p. 270. 1753.

S. pubens Michx., Fl., vol. 1, p. 181. 1803.
S. microbotrys Rydb., Bull. Torr. Bot. Club, vol. 28, p. 503. 1901.

Type locality.—"Habitat in Europae australis montosis."

Range.—Newfoundland to British Columbia, south to Georgia, Colorado, and California. Europe.

Zone.—Canadian to Arctic-alpine.

Specimens examined.—Ridge south of Donner Pass, 7,500 feet, Heller 7133; near Lake Lucile, Tahoe, 8,000 feet, Dudley, June 26, 1900; between Tahoe and Lake Lucile, 7–8,000 feet, Miss K. A. Chandler, September, 1901; Tragedy Springs, 7,500 feet, Hansen 796; Lake of the Woods meadow, Tahoe, 8,200 feet, Smiley 66; Lake Tenaya, Yosemite, 8,500 feet, Hall and Babcock 3507; Mt. Guyot, in shelter of rocks, 11,800 feet, H. M. and G. R. Hall 8426; Mt. Olancha, Tulare County, 9,500 feet, Hall and Babcock 5267.

Various attempts have been made to distinguish our western red-berried elder from the common shrub of the east, but with a large suite of specimens from the various sections for comparison, it appears impossible to maintain specific lines. Greene believed the shrub of the Coast Range to be distinct, relying upon an indeterminate flatness of the cyme as the distinguishing character; his *S. callicarpa* (Fl. Fran., p. 342. 1892) has its typical range in the coast mountains, but Greene suspected that it might also be found in the Sierra. Jepson (Fl. N.W. Calif., p. 395. 1910) considered this a variety of *S. racemosa.* When publishing *S. callicarpa,* Greene called attention to the red-berried elder of the northwest, ranging from Oregon to Alaska, and questioned whether it would prove to be identical with his new species. This shrub of the northwest coast Leiberg subsequently published as *S. leiosperma* (Proc. Biol. Soc. Wash., vol. 11, p. 40. 1897). Graf von Schwerin, in his monograph (Mitt. d. d. Dendrog. Gesellsch., vol. 18, pp. 1–56. 1909), considers these two forms to be "völlig identisch," an opinion shared by Piper. From an examination of many sheets in the Herbarium of the University of California and in the Dudley Herbarium, I am convinced that the contour of the cyme is a most untrustworthy character; Jepson calls it "ovate"; Piper "pyramidal," while Greene, when making determinations for Baker's Sierran collections, referred to *S. callicarpa* forms with obviously dome-shaped cymes.

S. microbotrys Rydb. is described as being completely glabrous. I have not seen Bessey's type from Pike's Peak, but have examined a fairly representative series of the red-berried elder from the Colorado-Montana region and believe that such an examination will lead inevitably to the conclusion that in the Cordilleran section, *S. racemosa* shows every gradation from being conspicuously pubescent to glabrate or even nearly glabrous.

2. **Sambucus melanocarpa** Gray, Proc. Am. Acad., vol. 19, p. 76. 1883.

Type locality.—Not given, "first collected in New Mexico by Fendler" (the only *Sambucus* collected by Fendler is his No. 286 from "Margins of Santa Fe Creek.")

Range.—Washington and Montana to California (east slope of the Sierra) and New Mexico.

Zone.—Canadian.

Specimen examined.—Snow Valley, Ormsby County, Nevada, 2,460–2,615 m., Baker 1155.

This collection is the only one of the black-berried elder seen by me from the Sierra. *Bolander* 5052, from the Tuolumne region, 10,000 feet, lacks the fruit but was referred here by Dr. Gray because of foliage character. *R. A. Ware* 2689c, from Lambert's Dome, Yosemite, 9,100 feet, is perhaps to be referred here.

2. SYMPHORICARPOS

Corolla pubescent within; nutlets of the drupe oval, the ends about equally rounded; leaves pubescent and thick ....1. **S. rotundifolius**

Corolla glabrous within; nutlets of the drupe obovate, cuneate, or conical at base; leaves glabrate and thinner ....2. **S. oreophilus**

1. **Symphoricarpos rotundifolius** Gray, Pl. Wright, vol. 2, p. 66. 1853.

S. Parishii Rydb., Bull. Torr. Bot. Club, vol. 26, p. 545. 1899.
S. Austinae Eastw., Bull. Torr. Bot. Club, vol. 30, p. 499. 1903.

Type locality.—"Sides of mountains around the copper mines, New Mexico."

Range.—Widely distributed in the Cordilleran region of North America and west to the Pacific Coast.

Zone.—Arid Transition to Canadian.

Specimens examined.—Half-Moon Lake, Tahoe, 7,760 feet, McGregor 53; Summit, Placer County, 7,000 feet, Heller 9846; head of Fall Creek, Ormsby County, Nevada, Baker 1496; Highland Lake, Alpine County, 8,500 feet, Abrams 4749; Summit Soda Springs, Dudley, September, 1896; Ralston Peak, Tahoe, 8,300 feet, Smiley 415; Mt. Tallac, talus slope on the east side, 9,000 feet, Smiley 246.

1a. **Symphoricarpos rotundifolius** var. **acutus** Frye and Rigg, Northwest Fl., p. 366. 1912.

S. mollis var. *acutus* Gray, Syn. Fl., vol. 1, pt. 2, p. 14. 1878.
S. vaccinoides Rydb., Mem. N. Y. Bot. Gard, vol. 1, p. 371. 1900.
S. acutus Howell, Fl. N.W. Am., vol. 1, p. 281. 1903.
S. glaucus Eastw., Bull. Torr. Bot. Club, vol. 30, p. 497. 1903.
S. parvifolius Eastw., *l.c.*, 498.

Type locality.—"Washington Terr. east of the Cascade Mountains."

Range.—Coincident with the species.

Zone.—Canadian, rising into the Hudsonian.

Specimens examined.—Glen Alpine trail, Tahoe, Dudley, June 28, 1900; Angora Peak, Tahoe, 7,900 feet, Smiley 1; Bullion Flat, Mt. Whitney trail, 8,700 feet, Dudley 2541; between Little Kern River and Farewell Gap, Tulare County, 9,000–10,500 feet, Dudley 1096.

The relationship of this perplexing form, whose inconstancy of character is indicated by the above synonymy, has become clearer since Dr. Gray first distinguished it as a variety of *S. mollis* Nutt. The collections made in the period subsequent to the publication of the variety in the Synoptical Flora indicate that its true relation is with the long-flowered section of the genus. Certain other characters (amount of the pubescence in the tube and the irregular leaf outline) suggest that it may well be regarded as the form from which the two localized and western species (Nos. 1–2) have diverged from the widely-ranging and northern *S. racemosus*—*S. mollis* group of species. It is of interest to note that in this latter group of species definite specific characters are difficult to formulate, especially in material from the Northwest;[121] see also the note under *S. oreophilus.*

2. **Symphoricarpos oreophilus** Gray, Jour. Linn. Soc., vol. 14, p. 12. 1873.

S. montanus Gray, *in* Enum. Pl., Parry, Am. Jour. Sci. II, vol. 34, p. 249. 1862.

Type locality.—"Hab.: Rocky Mountains, Colorado Territory and New Mexico to the eastern side of the Sierra Nevada, California."

Range.—Cordilleran section of the United States and westward.

Zone.—Canadian and above.

Specimens examined.—Shores of Donner Lake, Dudley, June 14, 1900; Heather Lake, Tahoe, Setchell and Dobie, July 6–21, 1901; Glen Alpine, Tahoe, Dudley, June 27, 1900; Mono Pass, Bolander 6339; Dana Creek, Tuolumne County, Chesnut and Drew, July 17, 1889; Tioga Pass, 9,300 feet, Smiley 821 (lacking in flowers).

Plants referable to *S. utahensis* Rydb. (Bull. Torr. Bot. Club, vol. 26, p. 544. 1899), which, to judge from the only specimen seen by me (Colorado: Van Boxle's Ranch, above Cimarron, 8,000 feet, Baker 384), is a well marked form and at least deserving varietal rank, as is accorded it by Dr. Nelson in the Coulter-Nelson Manual, have not come to my notice from the Sierra.

Jones has asserted (Proc. Calif. Acad. II, vol. 5, p. 690. 1895) that in the Great Basin intermediate forms between *S. rotundifolius* and *S. oreophilus* are so abundant that it is impossible to maintain the species separate and accordingly he proposes to regard *S. oreophilus* as a variety of the first species, a conclusion for which my own numbers, 1 and 246, might be presented as evidence.

3. LONICERA

Corolla yellow, its lobes only slightly unequal; bracts persistent.
  Bracts at summit of peduncle ovate-cordate, foliaceous and conspicuous; berry black ....1. **L. involucrata**
  Bracts at summit of peduncle linear-subulate, small and inconspicuous; berry with a blue bloom ....2. **L. coerulea**
Corolla dull red or purplish, strongly bilabiate; bracts subulate and caducous; berry red ....3. **L. conjugialis**

1. **Lonicera involucrata** var. **flavescens** Rehder, 14th Rep. Mo. Bot. Gard., p. 100. 1903.

L. flavescens Dippel, Gartenfl., vol. 37, p. 7. 1888.
L. intermedia Kellogg, Proc. Calif. Acad. I, vol. 2, p. 154. 1863.

Type locality.—"Am Fraserflusse," British Columbia.

Range.—Cascades and Sierra Nevada.

Zone.—Canadian.

Specimens examined.—Gold Lake, Sierra County, 6,400 feet, Hall and Babcock 4501; about Marlette Lake, Washoe County, Nevada, 2,460 m., Baker 1300; north side Slide Mountain, Washoe County, in granite, 7,850 feet, Heller 10954; Pohono trail, Yosemite, 7,500 feet, Hall 9155; Tuolumne meadows, Yosemite, 8,600 feet, R. A. Ware 2726c; Redwood Cabin, Tulare County, Culbertson (B 4330).

2. **Lonicera coerulea** L., Sp. Pl., p. 174. 1753.

Type locality.—"In Helvetia."

Range.—In America only certainly known from the Sierra Nevada (see below).

Zone.—Canadian.

Specimens examined.—Crescent Lake, Yosemite, Congdon, August 10, 1890; Tuolumne meadows, 8,600 feet, R. A. Ware 2625c; Westfall's meadows, Yosemite, Bolander 6338.

Dr. Gray recognized our Sierran form as distinct from the var. *villosa* T. and G. (Fl., vol. 2, p. 9), noting that in its villous corolla and hirsute calyx lobes it approaches the Eurasian type form and is separable from the variety found in the northern part of the continent and ranging south to New England, the Middle States, and Colorado, and on the Pacific Coast coming as far as Oregon (Proc. Am. Acad., vol. 8, p. 628. 1873). I have seen no representatives of the species from beyond the limits of California; Piper in the Flora of Washington, credits the species to that state and cites *Suksdorf* 559, a collection not seen by me, but he assigns as the range the territory over which the var. *villosa* is the predominant, if not the exclusive form. Dr. A. Nelson, in the Coulter-Nelson New Manual, follows the same course.

3. **Lonicera conjugialis** Kellogg, Proc. Calif. Acad. I. vol. 2, p. 67. 1863.

L. Breweri Gray, Proc. Am. Acad., vol. 6, p. 537. 1865.
Caprifolium conjugiale Kuntze, Rev. Gen. Pl., vol. 1, p. 274. 1891.
Xylosteum conjugiale Howell, Fl. N.W. Am., vol. 1, p. 282. 1900.
Lonicera sororia Piper, Bull. Torr. Bot. Club, vol. 29, p. 644. 1902.

Type locality.—"Washoe," Nevada. J. A. Veatch.

Range.—Cascades and Sierra Nevada. Blue Mountains of Oregon and Washington.

Zone.—Canadian.

Specimens examined.—Glen Alpine, Tahoe, 7,000 feet, W. W. Price, July 12, 1898; Suzy Lake trail, borders of a marsh, 7,700 feet, Smiley 186; high mountain near Donner Pass, Torrey 192, 196; Mt. Dyer, Plumas County, Mrs. R. N. Austin, July 1879; Gold Lake, Sierra County, 6,400 feet, Hall and Babcock 4500; Grass Lake, Tahoe, Miss Lathrop, July 19, 1909; ravine near Mt. Dana, 10,000 feet, Brewer 1802; Dog Lake, near Tuolumne meadows, Yosemite, 9,240 feet, Smiley 836; Glacier Point, Miss Camp, July, 1902; Mineral King, Tulare County, 8,000 feet, Culbertson (B 4313); Hockett trail, Tulare County, Dudley 1046; Soda Creek, Tulare County, 9–10,000 feet, Purpus 5234.

C. K. Schneider (Handb. d. Laubh., vol. 2, p. 74. 1911) gives as the place of first publication of this species "in Hesperian (San Francisco), V, p. 522. 1861." I have not been able to verify this reference.

56. VALERIANACEAE (Valerian Family)

1. VALERIANA

1. **Valeriana occidentalis** Heller, Bull. Torr. Bot. Club, vol. 28, p. 24. 1901.

V. californica Heller, Muhl., vol. 1, p. 60. 1904.

Type locality.—"Near the western end of the Craig Mountain Plateau, above Lake Waha, Nez Perces County, Idaho, altitude 3,500 feet."

Range.—Idaho to California.

Zone.—Canadian.

Specimens examined.—Ridge south of Donner Pass, 8,500 feet, Heller 7156; Luther's Pass, Tahoe, 7,800 feet, Abrams 4765; Pyramid Peak, 7,000 feet, W. S. Atkinson in 1900; Carson Spur, Alpine County, 8,500 feet, Hansen 725; Lake of the Woods, Tahoe, 8,200 feet, Smiley 47a; Mt. Goddard, 11,000 feet, Hall and Chandler 678; between Lake Tenaya and Tuolumne meadows, Yosemite, 9,500 feet, R. A. Ware 2680c; region of Dinkey Creek, Fresno County, 7,500 feet, Hall and Chandler 413; Mineral King, near Bullion Flat, 10,589 feet, Dudley 2575; Farewell Gap, Tulare County, 10,400 feet, Purpus 5274; Hockett's meadows, Tulare County, 8,500 feet, Culbertson (B 4376).

Differs from *V. acutiloba* Rydb. (Bull. Torr. Bot. Club, vol. 28, p. 24. 1901) of the Rocky Mountains in the cyme with the lower peduncles remote at anthesis and some of the basal leaves lobed or pinnately parted. The "*V. sylvatica* Banks" of the Syn. Fl., vol. 1, pt. 2, p. 43, and of the Bot. Calif., vol. 1, p. 287 (as *V. sylvatica* Richardson) includes a number of forms growing in the western mountains that may be divided into two groups with characters centering about the two species here contrasted.

Of the several species of *Campanula* present in the boreal floras of the Rocky Mountains and Cascades, none reach the Sierra, though *C. scabrella* Engelm. (Bot. Gaz., vol. 6, p. 237. 1881) was described from "bleak rocky ridges of Scott Mountain, west of Mount Shasta" and ranges north to Washington.

57. COMPOSITAE (Sunflower Family)

- Corollas all tubular and regular, or only the marginal ones ligulate.
  - Anthers not caudate at base; style branches either truncate or tipped with an appendage.
    - Heads discoid; flowers purplish, never yellow .... 1. **Eupatoreae**
    - Heads radiate (exceptional forms rayless); flowers commonly yellow.
      - Style branches of perfect flowers flat, or tipped with a distinct appendage; leaves mostly alternate .... 2. **Astereae**
      - Style branches not flattened, but truncate or appendaged; leaves often opposite.
        - Involucre not scarious, little imbricated.
          - Pappus never capillary.
            - Receptacle chaffy .... 3. **Heliantheae**
            - Receptacle not chaffy .... 4. **Helenieae**
          - Pappus capillary .... 5. **Senecioneae**
        - Involucre scarious, well imbricated; pappus, if present, never capillary but reduced to a low ring .... 6. **Anthemideae**
  - Anthers caudate at base; style branches neither truncate nor appendaged; heads discoid; leaves alternate.
    - Anthers short caudate at base, unappendaged at tip; involucral bracts scarious or white, never bristly (in ours) .... 7. **Inuleae**
    - Anthers long caudate and bearing elongated appendages at the tip; thistle-like .... 8. **Cynareae**
- Corollas all ligulate and flowers all perfect; plants with milky juice; leaves alternate .... 9. **Cichoreae**

1. EUPATOREAE

1. **Eupatorium**

2. ASTEREAE

- Pappus of two sorts, the inner of fine and long capillary hairs; the outer of very short, setulose hairs and inconspicuous; our species rayless .... 2. **Chrysopsis**
- Pappus of similar, though often unequal, hairs.
  - Rays, if present, always yellow.
    - Heads small and clustered.
      - Involucral bracts more or less in vertical rows; our species rayless (except *C. Bloomeri* has 2–4 rays) .... 3. **Chrysothamnus**
      - Involucral bracts not in vertical rows; heads always rayed .... 4. **Solidago**
    - Heads larger, distinct or loosely aggregated.
      - Involucral bracts few, subequal, and erect; pappus whitish or ferrugineous .... 5. **Haplopappus**
      - Involucral bracts numerous, of different lengths, and with divergent tips; pappus deep reddish brown .... 6. **Hazardia**
  - Rays, if present, never yellow, but white, blue, or reddish.
    - Involucral bracts broad, numerous, imbricated in several series; rays broad and comparatively few .... 7. **Aster**
    - Involucral bracts very narrow, fewer, arranged in two rows; rays very narrow and numerous .... 8. **Erigeron**

3. HELIANTHEAE

- Bracts of the involucre in several series, and none of them enclosing or wrapped about the outer achenes; ours large coarse perennial herbs.
  - Ray flowers fertile (our only species whitened with floccose wool) 9. **Wyethia**
  - Ray flower sterile (our only species nearly glabrous and green) .... 10. **Helianthella**
- Bracts of the involucre in a single series, and each enclosing one of the outer achenes; ours small, delicate annuals.
  - Ray achenes laterally compressed, each entirely enclosed by the adjacent involucral bract, which is strongly keeled outwardly .... 11. **Madia**

Ray achenes obcompressed or somewhat quadrangular; they and their adjacent enclosing bracts rounded on the external face.

Bracts of the receptacle united to form a cup about the few (often single) disk achenes; dwarf plants (not over 6 inches high) with mainly opposite leaves ....12. **Hemizonella**

Bracts of the receptacle distinct; plants 6–15 inches high with mainly alternate leaves ....13. **Hemizonia**

4. HELENIEAE

Heads radiate.

Plants nearly glabrous or early glabrate; paleae of pappus (5–10) acutely awned; plants of wet places ....14. **Helenium**

Plants lanate (at least at first); paleae obtuse or erose; plants of dry or rocky places.

Rays less than 15; involucral bracts in 1 series, firm, erect, and usually concave forming a cup about the achenes ....15. **Eriophyllum**

Rays 20–numerous (in *H. vestita* sometimes fewer or even wanting); involucral bracts in 2–3 series, soft, spreading, not enclosing the achenes ....16. **Hulsea**

Heads rayless.

Leaves entire, linear; slender annual ....17. **Orochaenactis**

Leaves lobed or pinnatifid; perennials ....18. **Chaenactis**

5. SENECIONEAE

Pappus of 15–25 short, soft, plumose bristles; our species rarely with a few rays ....19. **Raillardella**

Pappus of numerous slender bristles which are never truly plumose.

Bristles of the pappus rigidulous, barbellate, inserted in a single row upon the slender angled achene; leaves opposite; our species all radiate ....20. **Arnica**

Bristles of the pappus very numerous, white, and soft; achene terete; leaves alternate; our species both rayless and radiate ....21. **Senecio**

6. ANTHEMIDEAE

Ray flowers present, heads radiate; receptacle chaffy ....22. **Achillea**

Ray flowers none, heads discoid; receptacle naked.

Heads corymbose; anthers broad and obtuse at the tip ....23. **Tanacetum**

Heads racemose or panicled; anthers slender and acute at the tip ....24. **Artemisia**

7. INULEAE

Pappus hairs not clavate nor united into a ring at base; plant 1–2.5 feet high ....25. **Anaphalis**

Pappus of the staminate flowers clavate or barbellate; of the pistillate flowers capillary, united at base and falling together; plants usually less than 1 foot high ....26. **Antennaria**

8. CYNAREAE

27. **Cirsium**

9. CICHOREAE

Pappus none or short coroniform, paleaceous ....28. **Phalacroseris**

Pappus always present; not paleaceous.

Pappus of white and soft plumose bristles with paleaceous bases 29. **Microseris**

Pappus of simple capillary hairs or bristles.

Heads solitary on long scapose peduncles; achenes distinctly beaked ....30. **Agoseris**

Heads several to numerous on branching stems.

Leaves, or some of them, deeply lobed or pinnatifid; pappus copius, white and soft; achenes narrowed upward ....31. **Crepis**

Leaves entire or merely toothed; pappus of sordid bristles, scanty; achenes broad at the summit ....32. **Hieracium**

1. EUPATORIUM

1. **Eupatorium occidentale** Hook., Fl. Bor Am., vol. 1, p. 305. 1833.

Kyrstenia occidentalis Greene, Leaflets, vol. 1, p. 9. 1903.

Type locality.—"On the low hills between the north and south branch of Lewis and Clark's River in stony places." *Douglas.*

Range.—Washington and Idaho to California.

Zone.—Transition and lower Canadian, rarely higher.

Specimens examined.—Mineral King, Tulare County, 8,500 feet, Hall and Babcock 5695; Mt. Olancha, Tulare County, 9,500 feet, Rothrock 360; Mt. Hoffman, Yosemite, 8,500 feet, H. M. Evans, July, 1901; Ebbett's Pass, 7–8,000 feet, Brewer 2035; Suzy Lake, Tahoe, McGregor 126; Glen Alpine, W. W. Price, August 18, 1898; above Donner Lake toward Donner Pass, Heller 7124.

The form of this species growing in the higher mountains has the stems conspicuously reddened and leaves somewhat greener compared to the type prevalent in the Transition zone, which has light straw-colored stems and rather glaucous foliage, but all gradations occur.

2. CHRYSOPSIS

1. **Chrysopsis Breweri** Gray, Proc. Am. Acad., vol. 6, p. 542. 1866.

Type locality.—"Near Sonora Pass and Ebbett's Pass, in the Sierra Nevada, common at the elevation of 4,000 to 8,000 feet." *Brewer.*

Range.—Sierra Nevada.

Zone.—Canadian and Arid Transition.

Specimens examined.—Donner Lake, Greene 416; same locality, Torrey 214; above Donner Lake toward Donner Pass, Heller 7048; Thomas Cañon, Washoe County, Nevada, 8,000 feet, Kennedy 1813; head of Fall Creek, Ormsby County, Nevada, 2,460 m., Baker 1433; Mt. Tallac, Tahoe, near the summit, Miss K. Chandler, August 12, 1901; Pyramid Peak, 9,500 feet, Hall and Chandler 4728; Half-Moon Lake, Tahoe, 7,760 feet, McGregor 56; lateral moraine south of Fallen Leaf Lake, Tahoe, 6,800 feet, Abrams 4800; Silver Lake, Amador County, 8,000 feet, Hansen 772; near Ebbett's Pass, 4–8,000 feet, Brewer 2692; Cloud's Rest trail, Yosemite, 7,600 feet, Smiley 502; Nevada Falls, Yosemite, Chesnut and Drew, July 10, 1889; Snow Creek trail to Lake Tenaya, Yosemite, 7,800 feet, Smiley 673; near

Lake Tenaya, in pine forests, 8,300 feet, Hall and Babcock 3520; Farewell Gap region, Tulare County, Culbertson (B 4548); Grouse Ridge, near Alta Peak, Tulare County, Dudley 1563.

A very nearly related species, *C. Wrightii* Gray (Syn. Fl., vol. 1, pt. 2, p. 446) is found in the boreal region of the mountains of southern California.

3. CHRYSOTHAMNUS

Heads with 2–4 rays ....1. **C. Bloomeri**
Heads always rayless.
  Bracts of the involucre with conspicuous acuminations or tips.
    Bracts of the involucre with soft, slender, herbaceous tips ....2. **C. Bolanderi**
    Bracts of the involucre with rigid, recurved tips ....3. **C. nevadensis**
  Bracts of the involucre ovate or acute, but not drawn out into tips ....4. **C. nauseosus**

1. **Chrysothamnus Bloomeri** Greene, Erythea, vol. 3, p. 115. 1895.

Aplopappus Bloomeri Gray, Proc. Am. Acad., vol. 6, p. 541. 1866.

Type locality.—"On Mount Davidson, Nevada." *H. G. Bloomer.*

Range.—British Columbia to California and Nevada.

Zone.—Transition and Canadian (especially in the Jeffrey Pine belt in the Sierra).

Specimens examined.—Mt. Davidson, Bloomer, in 1864; head of Fall Creek, Ormsby County, Nevada, Baker 1498; Mt. Tallac, Tahoe, Miss L. K. Tangier-Smith; Whitney Creek, Tulare County, open woods, 9–10,000 feet, Purpus 1992; Soda Creek, Tulare County, flats at 7–8,000 feet, Purpus 5159.

1a. **Chrysothamnus Bloomeri** var. **angustatus** (Gray) Greene, *in* Merriam, N. Am. Fauna, vol. 16, p. 166. 1899.

Aplopappus Bloomeri var. *angustatus* Gray, Proc. Am. Acad., vol. 7, p. 354. 1868.

Type locality.—"On Mount Shasta, alt. 6,000 feet, Professor Brewer (1415); Little Yosemite Valley, Empire Camp on the Yosemite trail, and Soda Springs, alt. 9,700 feet, Bolander."

Range.—With the type.

Zone.—Canadian and above.

Specimens examined.—Mt. Stanford (Castle Peak), Hooker and Gray in 1877; Soda Springs of the Tuolumne, 9,700 feet, Bolander 5039; Mt. Olancha, 10,000 feet, Tulare County, Rothrock 357 (the last specimen differs from the type in the foliage being very slenderly linear, scarcely at all spatulate, thus approaching the characters of *Ericameria*).

The plant, determined by Greene as *C. Bloomeri*, and reported by Merriam (*l.c.*) as growing in the Hudsonian and even above timber line on Mt. Shasta, has not been seen, but it is probably of this variety, since *W. M. Canby* 113, collected on the same mountain at timber line, is of this variety. In the Sierra, the species scarcely enters the boreal region and Piper[72] assigns it to the Arid Transition exclusively in Washington.

2. **Chrysothamnus Bolanderi** Greene, Erythea, vol. 3, p. 114. 1895.

Linosyris Bolanderi Gray, Proc. Am. Acad., vol. 7, p. 354. 1868.

Type locality.—"Mono Pass, at 9–10,000 feet of elevation." *Bolander.*

Range.—Central Sierra Nevada.

Zone.—Canadian, rising into the Hudsonian.

Specimens examined.—Mono Pass, Bolander 6135; Soda Springs, Upper San Joaquin, Congdon, August 19, 1895; Mt. Warren, Tuolumne County, Congdon, August 21, 1894; Golden Trout Creek, Tulare County, 8–8,700 feet, H. M. and G. R. Hall 8413; Bloody Cañon, Mono County, Congdon C 125.

Coville[50] refers his No. 1690 to this species but notes its disagreement with the type of *C. Bolanderi* and suggests that it may belong to *C. Parryi* (Gray) Greene of the Rocky Mountains, a species not otherwise known west of Colorado and Wyoming. This number has been made the type of *C. asper* Greene (Leaflets, vol. 1, p. 81. 1904). I have had no opportunity to examine the specimen.

3. **Chrysothamnus Nevadensis** Greene, Erythea, vol. 3, p. 114. 1895.

Linosyris Howardi var. *nevadensis* Gray, Proc. Am. Acad., vol. 6, p. 541. 1866.

Type locality.—"Mount Davidson, Nevada, above Virginia City." *Bloomer.*

Range.—East slope of the Sierra Nevada, and in adjacent Nevada.

Zone.—Arid Transition and Canadian.

Specimens examined.—Mt. Davidson, Bloomer; Ebbett's Pass, Alpine County, hilltop at 9,000 feet, Brewer 1985, a dwarf form perhaps better included under the following variety.

3a. **Chrysothamnus nevadensis** f. *monocephala* (A. Nels. and Kennedy), forma nov.

Chrysothamnus monocephala A. Nels. and Kennedy, Proc. Biol. Soc. Wash., vol. 19, p. 39. 1906.

Type locality.—"Summit of Mount Rose, Washoe County, Nevada."

Range.—With the type?

Zone.—Hudsonian and arctic-alpine.

Specimens examined.—Mt. Rose, 10,000 feet, Heller 9976; same locality, 10,800 feet, Kennedy 1171.

In this form the stems bear but a single head and the plant appears somewhat more rigid or spinescent than in the species.

3b. **Chrysothamnus nevadensis** var. *vulcanicus* (Greene), var. nov.

C. vulcanicus Greene, Leaflets, vol. 1, p. 80. 1904.

Type locality.—"On Volcano Creek, above Volcano Falls, at 8,000 feet," Tulare County.

Range.—Southern Sierra Nevada.

Zone.—Canadian.

Specimens examined.—Volcano Creek, above Volcano Falls, 8,000 feet, Culbertson (B 4361); mountain slopes on Little Kern River, Tulare County, 9,300 feet, Purpus 5058.

This variety differs from the type in the reduced tomentum covering the twigs and in being less glandular-viscid.

4a. **Chrysothamnus nauseosus** var. *californicus* (Greene) Hall, Univ. Calif. Publ. Bot., vol. 7, p. 174. 1919.

C. californicus Greene, Erythea, vol. 3, p. 111. 1895.
Bigelovia graveolens var. *albicaulis* Gray, *in* Brewer and Wats., Bot. Calif., vol. 1, p. 317. 1876, as to the Sierran plant.

Type locality.—"Higher Sierra of Placer and Nevada Counties."

Range.—Central Sierra Nevada.

Zone.—Canadian.

Specimens examined.—Mono Pass, Bolander 6145; head of Fall Creek, Ormsby County, Nevada, 2,460 m., Baker 1495; summit of the Sierras near Donner Lake, E. L. Greene 411.

This variety differs from the type in the leaves being generally broader and the pubescence less developed.

4b. **Chrysothamnus nauseosus** var. **occidentalis** Hall, Univ. Calif. Publ. Bot., vol. 3, p. 60. 1907.

C. californicus var. *occidentalis* Greene, Erythea, vol. 3, p. 112. 1895.

Type locality.—"In the Coast Range from Humboldt County southward."

Range.—Southern Coast Range and southern Sierra Nevada to the mountains of southern California.

Zone.—Transition and Canadian.

Specimens examined.—Rocks near Little Kern River, 9–9,400 feet, Purpus 5059; Big Arroyo, Tulare County, Culbertson (B 4520).

This variety is very close to the preceding but with leaves narrower and greener.

The Rabbit-brush (*C. nauseosus* (Pall.) Britton), of which the two foregoing varieties are in places conspicuous elements in the boreal flora of the Sierra, is a typically Sonoran species, covering wide areas east of the mountains.

4. SOLIDAGO

1. **Solidago corymbosa** Nutt., Trans. Am. Phil. Soc., vol. 7, p. 328. 1840.

S. multiradiata var. *scopulorum* Gray, Proc. Am. Acad., vol. 17, p. 191. 1882.
S. ciliosa Greene, Pitt., vol. 3, p. 22. 1896.
S. hesperia Howell, Fl. N.W. Am., vol. 1, p. 303. 1900.
S. humilis f. *Crandalli* Gandoger, Bull. Bot. Soc. France, vol. 50, p. 215. 1903.

Type locality.—"Central chain of the Rocky Mountains." Nuttall.

Range.—British Columbia to Montana and south to California and New Mexico.

Zone.—Canadian to Arctic-alpine.

Specimens examined.—Mt. Rose, 10,000 feet, Kennedy 1146; Half-Moon Lake, Tahoe, 8,200 feet, Smiley 424; Mt. Dana, 10,500 feet, Hall and Babcock 3642; same locality, 11,000 feet, Smiley 719; Tuolumne River, 9,700 feet, Bolander 5051; Bloody Cañon, Mono County, 8,500 feet, R. A. Ware 2647c; Lambert's Dome, Yosemite, 9,300 feet, Smiley 761; summit near soda springs, Tuolumne River, 11,500 feet, Brewer 1792; Andrew's Camp, Inyo County, east slope of the Sierra, A. Davidson 2606; Kaiser Crest, Fresno County, 9,100 feet, Smiley 626; Farewell Gap, Tulare County, 10–11,000 feet, Purpus 1602; Mineral King, T. S. Brandegee, July 27, 1892; Rae Lake, Kings River region, Miss K. D. Jones 1293; Crabtree meadows, Tulare County, 10,330 feet, H. M. and G. R. Hall 8444; rocky slopes near Little Kern River, Tulare County, 9–10,500 feet, Purpus 2086.

Satisfactory characters by which *S. decumbens* Greene (Pitt., vol. 3, p. 161. 1897) and *S. dilatata* A. Nels. (Bot. Gaz., vol. 30, p. 196. 1900) can be distinguished from the foregoing species are unknown to me.

Solidago lepida DC. var. *elongata* (Nutt.) Fernald (Rhodora, vol. 17, p. 9. 1915), from which *S. caurina* Piper (Bull. Torr. Bot. Club, vol. 28, p. 40. 1901) is very feebly distinguished by the bracts of the panicle slightly larger, is present in the Sierra and just reaches our lower borders (Glen Alpine, Tahoe, 6,800 feet, McGregor 134; Summit, Placer County, E. L. Greene, August, 1883).

5. HAPLOPAPPUS

Heads rayless; branches whitened with lanate pubescence ....1. **H. discoideus**
Heads radiate; branches not whitened, commonly glandular.
  Leaves entire.
    Rays 2–5; involucral bracts foliaceous ....2. **H. suffruticosus**
    Rays 9–12; involucral bracts scarious margined ....3. **H. acaulis**
  Leaves toothed or pinnatifid; rays 20 or more.
    Achenes glabrous ....4. **H. apargioides**
    Achenes pubescent ....5. **H. eximius**

1. **Haplopappus discoideus** Hall and Hall, Yosemite Flora, p. 246. 1912.

Macronema discoidea Nutt., Trans. Am. Phil. Soc. II, vol. 7, p. 322. 1841.
Aplopappus macronema Gray, Proc. Am. Acad., vol. 6, p. 542. 1866.
Bigelovia macronema Jones, Proc. Calif. Acad. II, vol. 5, p. 693. 1895.

Type locality.—"Banks of Lewis' River, and other streams of the Oregon."

Range.—Mountains of Colorado west to California.

Zone.—Arctic-alpine and Hudsonian.

Specimens examined.—Castle Peak, 8,000 feet, Lemmon; Mt. Rose, 10,800 feet, Kennedy 1179; Mt. Stanford (Castle Peak), Hooker and Gray in 1877; Ralston Peak, Tahoe, 9,000 feet, Smiley 420; Mono Pass, on rocks at 10,000 feet, Bolander 6136; summit of Cloud's Rest, Chesnut and Drew; Ragged Peak, Yosemite, 10,100 feet, Smiley 835; Mt. Dana, Congdon, August 10, 1898; near Summit of Mt. Tallac, Tahoe, 9,500 feet, Abrams 4835; east side of Mt. Whitney, G. P. Rixford; mountains near Little Kern River, 11–12,000 feet, Purpus 5198; Sky Valley, Tulare County, Culbertson (B 1498); Siberian Pass, Upper Kern River, Hall and Babcock 5475.

Professor and Mrs. Hall in their Yosemite Flora cite Gray as the author of the combination "*Haplopappus discoideus*" but they now inform me that this was an inadvertence, the combination not having been previously made.

2. **Haplopappus suffruticosus** Gray, Proc. Am. Acad., vol. 6, p. 542. 1866.

Macronema suffruticosum Nutt., Trans. Am. Phil. Soc. II, vol. 7, p. 322. 1841.

Macronema grindelifolium Rydb., Mem. N.Y. Bot. Gard., vol. 1, p. 384. 1900.

Macronema grindelioides Rydb., Bull. Torr. Bot. Club, vol. 27, p. 619. 1900.

Macronema imbricata A. Nels. and Macbr., Bot. Gaz., vol. 52, p. 150. 1916.

Type locality.—"On the sandy and gravelly banks of the Malade, a stream of the Oregon near the Blue Mountains."

Range.—East Oregon to the southern Sierra Nevada, eastward on the mountains of the Great Basin to the Rockies of Montana, Wyoming, and Idaho.

Zone.—Hudsonian.

Specimens examined.—Summit of Sierra Nevada, E. L. Greene, October 14, 1874; Pyramid Peak, 10,000 feet, McGregor 165; ridge south of Donner Pass, about 8,500 feet, Heller 7182; Sierra County, Lemmon 97; Pyramid Peak, near Carson's Pass, 8–10,000 feet, Brewer 2141; Mt. Rose, 10,800 feet, Kennedy 1143; head of Fall Creek, Ormsby County, Nevada, 2,460 m., Baker 1498; Mono Pass, Bolander 6139; Rubicon Peak, Tahoe, in slide rock, 9,000 feet, Smiley 407; Mt. Hoffman, Yosemite, Congdon, August 18, 1890; meadows near Black Mountain, Fresno County, 10,000 feet, Hall and Chandler 617; mountain slopes on Soda Creek, Tulare County, 10–11,000 feet, Purpus; Mt. Guyot, from timber line up to 12,300 feet, H. M. and G. R. Hall 8425.

While in general the material from the northern Rockies has the leaves somewhat broader than much of our California representation, and in so far justifies Dr. Rydberg's statement that his *M. grindelifolium* has the foliage spatulate, yet such plants are by no means rare among our western collections (compare *Hooker and Gray* from Castle Peak). This breadth of leaf reaches a maximum in *Heller* 7182, which has been made the type of a new species, *M. imbricata*, which, in my opinion, is not distinguishable by characters of even varietal significance.

3. **Haplopappus acaulis** (Nutt.) Gray, Proc. Am. Acad., vol. 7, p. 353. 1867.

Stenotus acaulis Nutt., Trans. Am. Phil. Soc. II, vol. 7, p. 334. 1841.
Chrysopsis acaulis Nutt., Jour. Acad. Phila., vol. 7, p. 33. 1834.

Type locality.—"Near the borders of Little Godin River, in the Rocky Mountains."

Range.—Alberta south in the Rocky Mountains to Colorado, west to Oregon and California.

Zone.—Arid Transition to above timber-line.

Specimens examined.—Pyramid Peak, Tahoe, 9,600 feet, Smiley 127a; same locality, 9,500 feet, Hall and Chandler 4734; Castle Peak near the highest point, 9,000 feet, Heller 7104; Summit, Bolander, Kellogg and Co.; Deer Park Crag summit, Tahoe, Miss H. D. Geiss; Mt. Tallac, 9,600 feet, Hall and Chandler 4612; mountain on Truckee River, rocky peak at 8,200 feet, Sonne, July 18, 1886; near Lake Lucile, Tahoe, 8,500 feet, M. S. Baker, July 19, 1904.

As Dr. H. M. Hall has pointed out (Zoe, vol. 5, p. 266) both pubescent and glabrous achenes occur in this species, though the typical form as described by Nuttall has the achenes uniformly pubescent, so far as known. My own number from Pyramid Peak shows both pubescent and glabrous achenes in the same collection.

4. **Haplopappus apargioides** Gray, Proc. Am. Acad., vol. 7, p. 354. 1867.

Pyrrocoma apargioides Greene, Erythea, vol. 2, p. 70. 1894.

Type locality.—"At Soda Springs on the Tuolumne River (California), alt. 9,700 feet." *Bolander.*

Range.—Central Sierra Nevada to Tulare County. White Mountains, Inyo County.

Zone.—Hudsonian mainly.

Specimens examined.—Mountains above Summit Valley, 9,000 feet, Pringle, September 27, 1882; Sierra County, Lemmon in 1879; Mt. Stanford (Castle Peak), Sonne, July 19, 1885; soda springs, Tuolumne River, 9,700 feet, Bolander 5050; Dana-Lyell region, above Yosemite, Hall and Babcock, July, 1902; Tuolumne meadows, south side along forest edge, 8,600 feet, Smiley 711; same locality, 8,500–9,500 feet, Hall and Babcock 3434; soda springs of the Tuolumne, Chesnut and Drew, July 16, 1889; east of the Minarets, Mariposa County, Congdon, August 2, 1899; Bishop Creek, Inyo County, 10,000 feet, A. Davidson 2558; Crabtree meadows, Tulare County, 10,350 feet, Hall 8450; mountain near Whitney meadows, Tulare County, 11–12,000 feet, Purpus 1634; Funston's meadows, Tulare County, Dudley 2166; Whitney meadows, 2,850 m., Coville and Funston 1608.

This species is fairly common about the borders of the high sandy meadows but occasionally is also found on rocky outcrops, especially at the upper limit of its range.

5. **Haplopappus eximius** Hall, Univ. Calif. Publ. Bot., vol. 6, p. 170. 1915.

Type locality.—"Crevices of granite rocks at an altitude of 2,680 meters on a peak 1 kilometer S.S.W. of Angora Peak, El Dorado County, California."

Range.—Central Sierra Nevada (Tahoe Region).

Zone.—Hudsonian.

Specimens examined.—Ralston Peak, Tahoe, Miss H. D. Geiss 18; same locality, 8,800 feet, Smiley 417; same locality, G. R. Hall, July 30, 1910; near Angora Peak, 8,800 feet, G. R. Hall 8771.

This species represents in the Sierra that group, separated as the genus *Tonestus* by Dr. Nelson (Bot. Gaz., vol. 37, p. 262. 1904), but without distinct floral characters, which includes *H. Lyallii* Gray, alpine in the mountains of the Northwest from Oregon to British Columbia and extending east to Montana, and *H. pygmaeus* T. and G., a species of similar habitat in the mountains of Wyoming and Colorado and in the high mountains of northern New Mexico.

6. HAZARDIA

1. **Hazardia Whitneyi** (Gray) Greene, Pitt., vol. 3, p. 43. 1896.

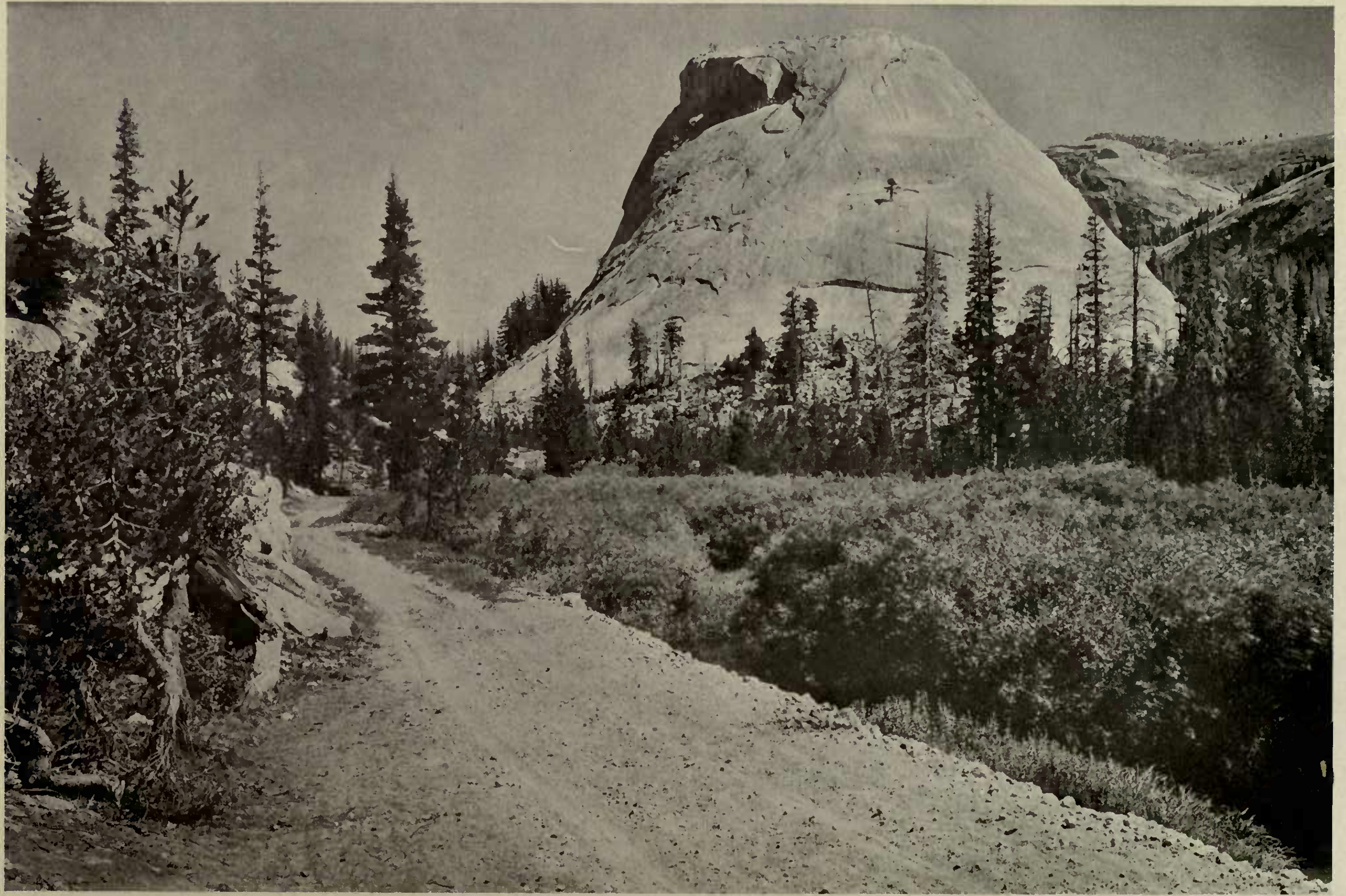
Aplopappus Whitneyi Gray, Proc. Am. Acad., vol. 7, p. 353. 1867.

Type locality.—"Mono trail and Sonora Pass, in open woods, alt. 9,000 feet; grows in large tufts, Bolander."

Range.—Siskiyou Mountains and Sierra Nevada.

Zone.—Transition and Canadian.

Specimens examined.—Mt. Dyer, Plumas County, Mrs. R. M. Austin in 1880; Glacier Point, Yosemite, W. M. Canby, August 15, 1895; Mono trail and Sonora Pass, open woods at 9,000 feet, Bolander 6008; Wawona Grove, Mariposa County, Hall and Babcock 1558; Mineral King, Tulare County, Brandegee, July 27, 1892; Mt. Silliman, Tulare County, Mrs. Brandegee, August 7, 1905; rocky slopes along Little Kern River, 9–10,000 feet, Purpus 2031; Farewell Gap region, Tulare County, 9,500 feet, Culbertson (B 4584).



CANADIAN OPEN FOREST AND STREAM-BANK VEGETATION, PINUS MURRAYANA DOMINANT; YOSEMITE REGION, VICINITY OF LAKE TENAYA. THE ROUNDED SUMMIT IS POLLY DOME.

7. ASTER

Leaves nearly all radical; scapes monocephalous.
  Stems 6–18 inches high, erect; achenes soft villous all over ....1. **A. Andersoni**
  Stems 2–6 inches high, decumbent-spreading; achenes sparingly pubescent or glabrate ....2. **A. pulchellus**
Plants with leafy stems; heads in an open panicle.
  Plants without glandular pubescence, not at all viscid; leaves narrow and mostly acute.
    Cauline leaves sessile; bracts of the involucre subequal and obscurely imbricated.
      Heads very large (½–1 inch broad); leaves often auriculate; upper part of the stem somewhat tomentulose ....3. **A. foliaceus**
      Heads smaller; leaves not auriculate, thin and deep green.
        Panicles leafy; involucral bracts with long tips; stems slender, sometimes decumbent ....4. **A. yosemitanus**
        Panicles with reduced leaves; involucral bracts not long pointed; stems stouter than in No. 4 ....5. **A. Fremontii**
    Cauline leaves tapering to a long winged peticle; bracts of 2 or 3 lengths, obviously imbricated ....6. **A. occidentalis**
  Plant viscidly glandular; leaves broad, spatulate or oblong (3–10 inches long); heads very large ....7. **A. integrifolius**

1. **Aster Andersoni** Gray, Proc. Am. Acad., vol. 7, p. 352. 1867.

Erigeron Andersoni Gray, Proc. Am. Acad., vol. 6, p. 540. 1866.
Oreastrum Andersoni Greene, Pitt., vol. 3, p. 147. 1896.
Oreostemma Andersoni Greene, Pitt., vol. 4, p. 224. 1900.

Type locality.—"Nevada, Carson City, Dr. C. L. Anderson. California, Lake Tenaya in the Sierra Nevada, alt. 8,000 feet, Prof. Brewer. Westfall's meadows in the Yosemite, 8,000 feet, and in the meadows on the Tuolumne, 9,700 feet, smaller and smoother specimens, H. N. Bolander."

Range.—Sierra Nevada and mountains of southern California.

Zone.—Canadian mainly, but rising in dwarf form to timber line or even above.

Specimens examined.—Ridge south of Donner Pass, 7,500 feet, Heller 7136; Sierra Nevada, Kellogg; Silver Lake, Amador County, 8,000 feet, Hansen 767; meadows near Forni, Pyramid Peak, 7,300 feet, Hall and Chandler 4756; Mt. Stanford (Castle Peak), grassy plots, 8,000 feet, Sonne, July 25, 1886; near Donner Lake, Torrey 208; Mt. Dana, Congdon, August 27, 1895; Elizabeth Lake, Yosemite, 9,800 feet, Smiley 794; Dana Fork meadows, Yosemite, 9,800 feet, Smiley 852; Lake Tenaya, 8,000 feet, Brewer in 1863; Tuolumne meadows, open wet meadow, 8,600 feet, R. A. Ware 2652c; same locality, 9,700 feet, Bolander 5057; Westfall's meadows, above Yosemite, 8,000 feet, Bolander 4974; Peregoy's, above Yosemite, A. Gray in 1872; Lake Tenaya, wet meadow, 8,150 feet, Smiley 680; Dinkey Creek, Bald Mountain, Fresno County, 7,500 feet, Hall and

Chandler 395; Nellie Lake, Fresno County, 8,700 feet, Smiley 606; foot of Mt. Whitney, 12,000 feet, Rothrock 394; Funston's meadows, Tulare County, 10,000 feet, Dudley 2171; Bonita meadow, Tulare County, 8,000 feet, Hall and Babcock 5173; Hockett's meadows, Tulare County, Culbertson, (B 4356); Mt. Goddard, 11,100 feet, Hall and Chandler 673.5; Mt. Warren Pass, Tuolumne County, Congdon, August 21, 1894; Alta meadows, Tulare County, R. Hopping 505; Mt. Silliman, Tulare County, Mrs. Brandegee, August, 1905.

This species is one of the commonest meadow plants of the higher mountains and appears in the wet meadows from near the Transition-Canadian boundary up through the boreal forest zones well into the alpine region; at the highest stations the leaves become much shorter and very narrow so that the plant is often overlooked, amid the grasses and sedges that make up the bulk of the vegetation, unless in flower.

2. **Aster pulchellus** Eaton, *in* Wats., Bot. King's Exped., p. 143, t. 16. 1871.

Oreastrum elatum Greene, Pitt., vol. 3, p. 147. 1896.

Type locality.—''Rocks at the base of South Clover Peak; 9,000 feet altitude.''

Range.—Southwestern Montana through the Great Basin to the Sierra Nevada.

Zone.—Hudsonian.

Specimens examined.—Mt. Rose, 9,650 feet, Heller 10655; soda springs, Tuolumne River, Congdon, August 15, 1894; head of Bloody Cañon, Tuolumne County, Congdon, August 16, 1894.

Rothrock reports (Rep. Wheeler's Exped., p. 364) this species from the southern Sierras. Coville notes a plant collected on the Death Valley Expedition (no. 2114) as growing ''in a meadow closely grazed by cattle, and it has the short spreading leaves and assurgent stems, but not the villous achenia, commonly characteristic of *A. pulchellus*'' (Contr. Nat. Herb., vol. 4, p. 125). But true *A. pulchellus* has the achenes practically glabrous as contrasted with the always hirsute achenes of *A. Andersoni,* the only other Aster of similar appearance in the Sierra; hence it appears that the plant of Coville's is probably true *A. pulchellus;* unfortunately as yet I have had no opportunity to examine this collection.

According to Dr. Rydberg, the true name of this species must be *Aster Haydeni* Porter, since the combination *A. pulchellus* is invalidated by an earlier combination of Willdenow, 1800.

A. Andersoni, A. pulchellus, and *A. alpigenus* Gray, the latter described from Mt. Rainier, form a very close group of species, satisfactory characters distinguishing the second and third being particularly difficult to define, but the plant of Washington seems to consistently show larger heads and broader leaves than the Great Basin form.

3. **Aster foliaceus** Lindl., *in* DC. Prodr., vol. 5, p. 228. 1836.

Type locality.—''In Unalaschka.''

Range.—Alaska to California and east to northern New England and Newfoundland.

Zone.—Canadian and Hudsonian.

Specimens examined.—Open places in woods near Summit, 7,000 feet, E. L. Greene 428; Mono Pass, Bolander 6146; Lake Tenaya trail, Yosemite, Congdon, August 14, 1894; Kaweah meadows, Tulare County, 9,400 feet, Purpus 5162.

3a. **Aster foliaceus** var. **apricus** Gray, Syn. Fl., vol. 1, pt. 2, p. 193, 1884.

A. apricus Rydb., Mem. N. Y. Bot. Gard., vol. 1, p. 396. 1900.
A. incertus A. Nels., Bot. Gaz., vol. 37, p 270. 1904.

Type locality.—''High mountains of Colorado, at Union Pass, *Rothrock,* and near Gray's Peak, at 11,000–12,000 feet, in open and very dry places, *Patterson.* On Mount Paddo, Washington Terr., *Suksdorf. Howell,''* etc.

Range.—Washington to California and Colorado?

No specimen certainly referable to this variety has been seen from our region, but No. 417 of the collection made on the Wheeler Survey and collected near soda springs on Kern River is a very close match for material referred to this variety.

3b. **Aster foliaceus** var. **frondeus** Gray, Syn. Fl., vol. 1, pt. 2, p. 193. 1884.

Type locality.—''Subalpine on the Cascade and Rocky Mountains, from the borders of Brit. Columbia to those of Colorado and the Wahsatch in Utah.''

Range.—British Columbia to Colorado, and south to California?

Specimen examined.—South Fork of Kern River, 9,850 feet, Rothrock 372.

This variety, which differs from the species in the narrower bracts of the involucre, is said by Dr. Greene (Fl. Fran., p. 382) to be present in the mountains of Plumas County.

4. **Aster yosemitanus** Greene, Fl. Fran., p. 383. 1897.

A. adscendens var. *yosemitanus* Gray, Syn. Fl., vol. 1, pt. 2, p. 191, 1884.

Type locality.—"Sierra Nevada, from Summit to the Yosemite Valley."

Range.—Central Sierra Nevada; perhaps extending to Tulare County.

Zone.—Transition and Canadian.

Specimens examined.—Near Glen Alpine, Tahoe, Miss K. Chandler, August-September, 1904; Cascade Lake, Tahoe, 6,400 feet, Hall 8812; Crescent Lake, Mariposa County, 7–8,000 feet, Congdon, August 23, 1889; meadows along Little Kern River, Tulare County, 9,400 feet, Purpus 2089; Tioga Road near Dark Hole, 7,700 feet, Smiley 879.

5. **Aster Fremonti** Gray, Syn. Fl., vol. 1, pt. 2, p. 191. 1884.

A. adscendens var. *Fremonti* T. and G., Fl. N. Am., vol. 2, p. 503. 1843.
A. Durbrowi Eastwood, Proc. Calif. Acad. III, vol. 2, p. 293. 1902.

Type locality.—Not given; collected by Fremont in the Wind River Mountains, Wyoming.

Range.—Rocky Mountains from Montana to Colorado, west to the Pacific Coast.

Zone.—Transition and Canadian.

Specimens examined.—Summit Valley, 7,500 feet, Pringle, September 22, 1882; Old Cisco, Placer County, grassy flats along Yuba River, 5,700 feet, Hall 8757; above Donner Lake, meadows along the creek, C. F. Sonne, August, 1897; Bloody Cañon, Mono County, Chesnut and Drew, July 26, 1889; Red Rock meadow, Tulare County, 8,700 feet, H. M. and G. R. Hall, 8398.

6. **Aster occidentalis** Nutt., *in* T. and G., Fl. N. Am., vol. 2, p. 164. 1841.

Type locality.—"By the margins of muddy ponds in the Rocky Mountains, seven thousand feet above the level of the sea."

Range.—Washington to California, east to Idaho and Nevada.

Zone.—Arid Transition and above, even to above timber line as a depauperate form.

Specimens examined.—Silver Lake, Amador County, 8,000 feet, Hansen 768; Summit Soda Springs, Kennedy and Doten; Fallen Leaf Lake, Tahoe, 6,400 feet, Hall 8778; head of Mono Pass, Congdon, no. 51, 1896; meadows near Little Kern River, 11–12,000 feet, Purpus 5209.

7. **Aster integrifolius** Nutt., Trans. Am. Phil. Soc. II, vol. 7, p. 291. 1840.

Type locality.—"Near the summit of Thornberg's Ridge" (Wyoming).

Range.—Montana to Colorado and westward to the Pacific Coast.

Zone.—Transition and Canadian.

Specimens examined.—Summit, Kellogg; Hermit Valley, Alpine County, 8,000 feet, Hansen 382; near Summit, 7,000 feet, E. L. Greene 433; Webber Lake, Lemmon 1100; Little Valley, Washoe County, Nevada, 2,000–2,150 m., Baker 1470; south side of Slide Mountain, Washoe County, 8,200 feet, Heller 10669; soda springs of the Tuolumne, Congdon, August, 1894; Tamarack trail to the Lake of the Woods, Tahoe, 8,200 feet, Smiley 264; Ostrander's near Yosemite, 8,000 feet, Bolander 6166; Alta meadows, Tulare County, R. Hopping 502; Hockett's meadows, Tulare County, 8,500 feet, Hall and Babcock 5635; dry meadows along Little Kern River, 9–10,000 feet, Purpus 2005; North Fork of Middle Tule River, Tulare County, 7,800 feet, H. M. and G. R. Hall 8480; Little Kern River, Tulare County, Culbertson (B 4549).

8. ERIGERON

- Cauline leaves numerous, though often reduced in size.
  - Heads radiate.
    - Rays violet.
      - Cauline leaves gradually reduced upwards from the base of the flowering stems; leaves smooth .... 1. **E. salsuginosus**
      - Stems equably leafy to the top; leaves scabrid.
        - Stems 6–20 inches high, erect; leaves obtuse .... 2. **E. Breweri**
        - Stems 3–10 inches high, decumbent; leaves acute .... 3. **E. Elmeri**
    - Rays white or pink.
      - Rays conspicuous, much exceeding the disk.
        - Stems few, erect, 10–20 inches high; leaves thin, green, puberulent or glabrous; rays 50–70 .... 4. **E. Coulteri**
        - Stems many, ascending or spreading; leaves thickish, with dense, soft pubescence; rays 40–50 .... 5. **E. caespitosus**
      - Rays inconspicuous, very short and numerous, scarcely exceeding the disk .... 6. **E. lonchophyllus**
  - Heads rayless.
    - Leaves glabrous, linear; stem stiffly erect, 1–2 feet .... 7. **E. inornatus**
    - Leaves soft-hirsute, spatulate; stems spreading .... 8. **E. miser**

Leaves mainly or entirely radical.
  Leaves lobed or trifid .... 9. **E. compositus**
  Leaves entire.
    Plant silvery-whitish .... 10. **E. tener**
    Plants green.
      Leaves cinerous; rays fewer (20–40); greenish involucral bracts hirsute or hispid with straight hairs .... 11. **E. nevadensis**
      Leaves nearly glabrate, ciliate; rays numerous (35–50); purplish involucral bracts with long crinite hairs .... 12. **E. ursinus**

1. **Erigeron salsuginosus** Gray, Proc. Am. Acad., vol. 16, p. 93. 1880.

Aster salsuginosus Richards., Bot. App. Frankl. Jour., vol. 2, p. 748. 1823.

Type locality.—"On the salt plains in the Athabasca."

Range.—Subarctic America west of Hudson's Bay, south to New Mexico and California.

Zone.—Canadian mainly, rising into the Hudsonian.

Specimens examined.—About Summit Station, Heller 6974; Cisco, Placer County, 6,100 feet, Hall 8754; moist hillside near Summit, 7,000 feet, Smiley 437; Half-Moon Lake, Tahoe, 7,760 feet, McGregor 78; Grass Lake trail, Tahoe, Miss Lathrop, July 19, 1909; Peregoy's meadows, above Yosemite, A. Gray in 1872; Ostrander's, above Yosemite, Bolander 5029; Mt. Dana, Bolander 6185; meadows on Soda Creek, Tulare County, 8–9,000 feet, Purpus 5173; meadows near Farewell Gap, Tulare County, 10,200 feet, Purpus 1489; Hockett's meadows, Tulare County, Culbertson (B 4463); Alta meadows, Tulare County, G. B. Grant 5320; Crabtree meadows, Tulare County, 10,200 feet, H. M. and G. R. Hall 8452.

1a. **Erigeron salsuginosus** var. **angustifolius** Gray, Proc. Am. Acad., vol. 16, p. 93. 1880.

Aster salsuginosus var. *angustifolius* Gray, Bot. Calif., vol. 1, p. 325. 1876.
Erigeron angustifolius (Gray) Rydb., Bull. Torr. Bot. Club, vol. 24, p. 295. 1897.

Type locality.—"Sierra County."

Range.—Coincident with the species.

Zone.—Hudsonian, and also in the Canadian.

Specimens examined.—Pyramid Peak, 10,000 feet, Brewer 2138; Desolation Valley, Tahoe, 8,400 feet, Hudsonian Zone, Smiley 94; about Marlette Lake, Washoe County, Nevada, 2,460 m., Baker 1384; Angora Ridge, Tahoe, edge of meadow, 7,300 feet, Hall 8801; Bloody Cañon, Mono County, Congdon, C 138; Tuolumne meadows, Yosemite, 8,650 feet, R. A. Ware 2699c.

E. membranaceus Greene (Pitt., vol. 3, p. 294. 1898), described from ''Eastern Oregon, at 5,000 to 6,000 feet in the mountains,'' seems indistinguishable from the species; the thinness of the foliage, adduced to separate, is too evidently a reaction to the habitat for acceptance as a valid character.

2. **Erigeron Breweri** Gray, Proc. Am. Acad., vol. 6, p. 341. 1865.

Type locality.—''Yosemite Valley, alt. 4,000 feet; in flower. Near Carson City, Nevada, Dr. C. L. Anderson; in fruit.''

Range.—California and adjacent Nevada, northward to southern Oregon.

Zone.—Transition, rising into the Canadian.

Specimens examined.—Suzy Lake, Tahoe, 7,650 feet, McGregor 115; dry soil above Fallen Leaf Lake, Miss Lathrop, July 12, 1909; Fallen Leaf Lake, 6,400 feet, Hall 8784; below Suzy Lake, Tahoe, 7,600 feet, Smiley 182; trail above Glen Alpine, Tahoe, 7,400 feet, Mrs. C. C. Hall, 8789; Summit, Alpine County, 9,000 feet, Hansen 383; Tuolumne meadows, Yosemite, 8,500 feet, Smiley 712; soda springs of the Tuolumne, J. B. Lembert, July, 1894; Sentinel Dome, Yosemite, Hooker and Gray in 1877; Shuteye Mountain, Madera County, 7,800 feet, J. Murdoch Jr., 2591; South Fork of the San Joaquin, 5–10,000 feet, J. Muir 4; Mt. Silliman, Tulare County, Mrs. Brandegee, August, 1905; Kaweah meadows, Tulare County, 8–9,000 feet, Purpus 5170; Mineral King, Brandegee, July 27, 1892; Alta meadows, Tulare County, R. Hopping 521; Olancha Mountain, Tulare County, 9,500 feet, Rothrock 362.

3. **Erigeron Elmeri** Greene, Fl. Fran., p. 393. 1897.

Aster Elmeri Greene, Pitt., vol. 2, p. 170. 1891.

Type locality.—''In the Grand Cañon of the Tuolumne River, California.''

Range.—Central and southern Sierra.

Zone.—Canadian.

Specimens examined.—Glacier Point, Miss Eastwood, July 5–19, 1902; near Lake Tenaya, growing in cracks of rocks, 8,200 feet, Hall and Babcock 3634; Monarch Creek, Tulare County, 9,000 feet, Hall and Babcock 5697; Copper Creek, Tulare County, F. Grinnell, August 11, 1914.

4. **Erigeron Coulteri** Porter, *in* Porter and Coulter, Fl. Colo., p. 61. 1874.

E. frondeus Greene, Fl. Fran., p. 388. 1897.

Type locality.—"Weston's Pass, at 10,000 feet altitude."

Range.—Rocky Mountains from Wyoming to New Mexico, west to the Sierra Nevada.

Zone.—Canadian and rarely in the Hudsonian.

Specimens examined.—Near Summit, by a swift mountain stream, Greene 420; upper end of Donner Lake, Heller 6964; Truckee River, Heller, July 30, 1903; Half-Moon Lake, 7,760 feet, McGregor 57; trail from Summit to Castle Peak, 7,800 feet, nearly glabrous, Smiley 464; Luther's Pass, Tahoe, 7,800 feet, Abrams 4761; Lake Valley, Tahoe, 6,400 feet, Abrams 4767; Summit Soda Springs, Kennedy and Doten 260; Carson Spur, Alpine County, 8,500 feet, Hansen 773; Mono trail, 9,000 feet, Bolander 6010; vicinity of Lundy, Mono County, 8–9,000 feet, Miss M. Minthorn 55; Lake Tenaya trail, Yosemite, Congdon, August 14, 1894; Bloody Cañon, Chesnut and Drew, July 26, 1889; above Lake Tenaya, 8,300 feet, Smiley 869; Crabtree meadows, Tulare County, 10,330 feet, H. M. and G. R. Hall 8443; meadows near Soda Creek, Tulare County, 8–9,000 feet, Purpus 5171; Sky Valley, Tulare County, Culbertson (B 4575).

This is the only white flowered Erigeron of wet meadows and stream banks in the higher mountains. *E. frondeus* is merely the larger size of the species; these taller plants are often somewhat scabrous (*Smiley* 869 above).

5. **Erigeron caespitosus** Nutt., Trans. Am. Phil. Soc. II, vol. 7, p. 307. 1841.

Type locality.—"On the summits of dry hills in the Rocky Mountain range, on the Colorado of the West."

Range.—Alberta to New Mexico and westward to the mountains of the Great Basin and east slope of the Sierra Nevada.

Zone.—Arid Transition mainly, rising into the Canadian.

Specimens examined.—Mono Pass, Congdon, no. 58, 1896; same locality, 10,000 feet, R. A. Ware, 2723c; same locality, State Survey 6154 (as in University of California).

6. **Erigeron lonchophyllus** Hook., Fl. Bor. Am., vol. 1, p. 18. 1834.

E. racemosus Nutt., Trans. Am. Phil. Soc. II, vol. 7, p. 312. 1841.

Type locality.—"Saskatchewan."

Range.—Saskatchewan southward to Colorado, and west to the Sierra Nevada.

Zone.—Arid Transition and Canadian.

Specimens examined.—Soda springs of the Tuolumne, Chesnut and Drew, July 16, 1889; Andrew's Camp, Inyo County, A. Davidson 2560; soda springs, Yosemite, moist meadows, 9,700 feet, Bolander 5040; Hockett's meadows, 8,600 feet, Culbertson (B 4320); swamp near Mt. Brewer, Brewer 2828; trail to Mt. Whitney, 9,000 feet, Culbertson (B 4423).

7. **Erigeron inornatus** Gray, Proc. Am. Acad., vol. 16, p. 88. 1881.

E. foliosum var. *inornatum* Gray, Bot. Calif., vol. 1, p. 330. 1876.

Type locality.—"Mendocino Co., *Kellogg* and *Harford,* in several forms; upper Sacramento (*Newberry, 'E. Douglasii,* var.'); near Donner Lake (Torrey), and Sierra Valley, *Lemmon,* etc."

Range.—Northern Coast Ranges and northern Sierra Nevada.

Zone.—Transition and Canadian.

Specimens examined.—Charity Valley, Alpine County, 8,500 feet, Hansen 416.

Said by Hall (Yosemite Fl., p. 252) to grow in the Yosemite region along the Tioga Road.

8. **Erigeron miser** Gray, Proc. Am. Acad., vol. 13, p. 372. 1878.

Type locality.—"Sierra Nevada, California, in crevices of rocks at Donner Lake, *E. L. Greene,* October, 1874; and above, on or near the summit of Mt. Stanford."

Range.—Sierra Nevada from the Tahoe region to Yosemite.

Zone.—Canadian.

Specimens examined.—Above Donner Lake below Donner Pass, Heller 7012; crevices of rocks at Donner Lake, E. L. Greene 466; near top of Mt. Stanford (Castle Peak), Hooker and Gray in 1877; Summit, Jones 2606; slope above Suzy Lake, Tahoe, 7,900 feet, Smiley 154; above Donner Lake on rocky ledges, Sonne, August 7, 1897; Glacier Point, Yosemite, Congdon, July 24, 1891.

9. **Erigeron compositus** var. **trifidus** Gray, Proc. Am. Acad., vol. 16, p. 90. 1881.

E. trifidus Hook., Fl. Bor. Am., vol. 2, p. 17, t. 120. 1834.
E. flabellifolius Rydb., Bull. Torr. Bot. Club, vol. 26, p. 545. 1899.

Type locality.—"Barren places among the Rocky Mountains" of Canada.

Range.—Alberta to Colorado, west to the Cascades and Sierra Nevada. Mountains of southern California (with rays obsolete—see note below).

Zone.—Arctic-alpine, rarely in the Hudsonian.

Specimens examined.—Castle Peak, near the highest point, 9,000 feet, Heller 7103; same locality, dry rocks at 8,500 feet, Sonne, July, 1892; Mt. Tallac, Tahoe, Setchell and Dobie, July 6–21, 1901; Mt. Rose, Kennedy 1172;* Mt. Dana, 12,000 feet, Bolander 5081; same locality, up to 12,200 feet, Hall and Babcock 3614a; Dicks Peak, Tahoe, 9,900 feet, Smiley 429;† Mt. Gibbs, Yosemite, 12,000 feet, Smiley 778; Mt. Goddard, 12,500 feet, Hall and Chandler 665; Mt. Lyell, Cassiope Crest, 11,000 feet, Hall and Babcock 3572; Mt. Dana, above the saddle, Chesnut and Drew, July 17, 1889; Farewell Gap, Tulare County, 10,700 feet, Purpus 5273; Cirque Peak, Tulare County, 12,000 feet, Hall and Babcock 5500; Mt. Whitney, 12,500 feet, Hall and Babcock 5538.

10. **Erigeron tener** Gray, Proc. Am. Acad., vol. 16, p. 91. 1880.

E. caespitosus var. *tener* Gray, Bot. Calif., vol. 1, p. 328. 1876.

Type locality.—"Summit of Silver Mountain near Ebbett's Pass, alt. 11,000 feet." *Brewer* 2043.

Range.—Sierra Nevada and mountains of Nevada.

Zone.—Canadian and Hudsonian.

Specimens examined.—Silver Mountain, Alpine County, 11,000 feet, Brewer 2043; mountains about the headwaters of the Sacramento, 8,000 feet, Pringle, August 19, 1881.

In the Synoptical Flora the range of this species is given so as to include *E. Tweedyi* Canby (Bot. Gaz., vol. 13, p. 17. 1888) of Wyoming and southern Montana, a species which seems entirely distinct by its broader leaves, different kind of pubescence, and length of peduncles.

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* This collection more nearly approaches var. *pinnatisectus* Gray, a form of the Colorado mountains, distinguished by the leaves pinnately parted into linear segments, than any other seen from within our limits.

† Some of the specimens cited above differ from the typical form with numerous rays, by having the rays abortive or in some heads apparently entirely wanting; this is the var. *discoideus* Gray (Am. Jour. Sci. II, vol. 33, p. 237. 1862), but there seems to be every conceivable gradation from heads with the normal number of well developed rays to the eradiate condition; my No. 429 represents this rayless state.

11. **Erigeron nevadensis** var. **pygmaeus** Gray, Proc. Am. Acad., vol. 8, p. 649. 1873.

E. pygmaeus Greene, Fl. Fran., p. 390. 1897.

Type locality.—"Above Ebbett's Pass and at Mono Pass, California, alt. 9,500 to 10,750 feet, *Brewer.*"

Range.—Sierra Nevada and mountains of western Nevada.

Zone.—Arctic-alpine, rarely lower.

Specimens examined.—Mt. Dyer, Plumas County, Mrs. Austin in 1879; Mt. Stanford (Castle Peak), 8,000 feet, Bolander, Kellogg and Co.; same locality, C. F. Sonne 17; same locality, 9,000 feet, Smiley 484; Bloody Cañon, Mono County, Congdon, C 141, C 139; Mt. Dana, Congdon, no. 46.1896; Mt. Warren Pass, Congdon, August 21, 1894; Mt. Rose, 10,500 feet, Heller 9867; above Ebbett's Pass, 9,500 feet, Brewer 2008; Mt. Dana, rockfield on the northwest side, 11,600 feet, Smiley 725; same locality, 12,200 feet, Hall and Babcock 3614; high summit on the range east of the Minarets, Mariposa County, Congdon, August 24, 1899; Kaiser Crest, Fresno County, dry loose sand at 9,400 feet, Smiley 628; Siberian Pass, Hall and Babcock 5478; Mt. Olancha, Tulare County, 11–12,000 feet, Purpus 3008; Old Mt. Whitney, 12–13,000 feet, Purpus 1427, 1578.

11a. **Erigeron nevadensis** var. **Sonnei** (Greene), comb. nov.

E. Sonnei Greene, Pitt., vol. 1, p. 218. 1888.

Type locality.—"Western slope of the Washoe Mountains, Nevada."

Range.—East slope of the central Sierra Nevada.

Zone.—Hudsonian.

Specimens examined.—Ward's Peak, Placer County, Sonne, July 29, 1888; Mt. Stanford (Castle Peak), high rocky ridges, Sonne 365; Lucile Crest, Tahoe, 8,500 feet, M. S. Baker, July 19, 1904; ridge between LeConte and Heather lakes, Tahoe, 8,800 feet, Smiley 343.

The leaves in var. *pygmaeus* have cinereous pubescence and are somewhat spatulate, while the foliage in the second variety has strigose pubescence and the shape of the leaves is linear-acute.

12. **Erigeron ursinus** Eaton, *in* Wats., Bot. King's Exped., p. 148. 1871.

Type locality.—"Uinta Mountains, on the ridge above Bear River Cañon; 10,000 feet elevation."

Range.—Colorado and Wyoming west to California.

Zone.—Arctic-alpine.

Specimens examined.—Castle Peak near the highest point, 9,000 feet, Heller 7088; mountain at head of Squaw Valley, Placer County, Sonne 8; Mt. Dana, 12,800 feet, Bolander 5083; same locality, near the summit at 13,000 feet, Lemmon 1429; Mt. Gibbs, 12,000 feet, Smiley 779; Cloud's Rest, summit, Chesnut and Drew, July 12, 1889; Mt. Lyell, 11,000 feet, Hall and Babcock 3573; Mt. Goddard, 11,500 feet, Hall and Chandler 704; Tuolumne County, 10,000 feet, Turner, July 19, 1898; mountains near Kaweah meadows, Tulare County, 10–11,500 feet, Purpus 1801.

Erigeron uniflorus L., a holarctic species alpine on the mountains of Colorado and New Mexico and also in the Cascades of Washington, is perhaps represented in the Sierra by a collection of Dr. Kellogg, made in 1873 at 10,000 feet, "On high peaks of the Sierra," probably in the Tahoe region; the specimen lacks the definite character of typical *E. uniflorus,* the copious black hairs on the involucre, and, in my opinion, is more likely to be a peculiar state of the preceding species.

9. WYETHIA

1. **Wyethia mollis** Gray, Proc. Am. Acad., vol. 6, p. 544. 1865.

Type locality.—"Mono Lake and summit of Sonora Pass in the Sierra Nevada."

Range.—Central Sierra Nevada, especially on the eastern slope.

Zone.—Transition and locally in the Canadian.

Specimens examined.—Fallen Leaf Lake, in dry places, Miss Lathrop, July 9, 1909; Donner Lake, Heller 6902; Caples Lakes, Alpine County, 8,500 feet, Hansen 421; Sierra County, Lower Sardine Lake, 6,000 feet, Hall and Babcock 4486; east slope of the Sierras, Bolander 6024; vicinity of Lake Tenaya, 8,200 feet, Hall and Babcock 3543; Luther's Pass, Tahoe, 7,800 feet, Abrams 4764.

Wyethia is a genus peculiar to the Cordilleran and Pacific region of the United States, with fifteen species, seven of these being confined to California.

10. HELIANTHELLA

1. **Helianthella nevadensis** Greene, Bull. Calif. Acad., vol. 1, p. 89. 1884.

Type locality.—"In the higher Sierra."

Range.—Central Sierra Nevada.

Zone.—Transition and Canadian (lower).

Specimens examined.—Summit, Mrs. Curran, August, 1883; along Coldstream, 3 miles above Truckee, Heller 7006.

Possibly merely a state of *H. californica* Gray, a species confined to California but present in the Coast Ranges and mountains about the north end of the Sacramento Valley, as well as in the Sierra as far south as the Yosemite region.

11. MADIA

1. **Madia glomerata** Hook., Fl. Bor. Am., vol. 2, p. 24. 1834.

Type locality.—"Plains of the Saskatchewan, *Drummond.*"

Range.—Widely distributed in western North America from the Yukon to New Mexico and California.

Zone.—Upper Transition and lower Canadian.

Specimens examined.—Near Lily Lake, Tahoe, 6,500 feet, Smiley 311; base of Angora Peak, Tahoe, 6,700 feet, Smiley 293; Iceberg meadow, Clark's Fork, Alpine County, 6,500 feet, Abrams 4743; Corral Flat, Amador County, 7,500 feet, Hansen 727; Snow Creek, Yosemite, 6,700 feet, Hall 9189.

12. HEMIZONELLA

1. **Hemizonella minima** var. **parvula** (Gray) Hall, Univ. Calif. Pub. Bot., vol. 3, p. 148. 1907.

Hemizonia parvula Gray, Proc. Am. Acad., vol. 6, p. 549, 1865.
Hemizonia Durandi Gray, l.c.
Harpaecarpus parvulus Greene, Fl. Fran., p. 416. 1897.

Type locality.—"Klamath Valley, Oregon."

Range.—Sierra Nevada and mountains of southern California; also in southern Oregon.

Zone.—Transition and Canadian.

Specimens examined.—Deer Park, Tahoe, in shade of *Pinus Jeffreyi*, Miss H. A. Walker, 2036; dry bank near Fallen Leaf Lake, 7,000 feet, Smiley 294; Cisco Butte, Placer County, 6,500 feet, Hall 8760; Tuolumne meadows, Yosemite, dry sunny places on the meadows, 8,500 feet, Smiley 737;* Snow Creek, Yosemite, 7,100 feet, Smiley 666; between Nevada Falls and Cloud's Rest, A. Gray in 1872; Alta meadows, Tulare County, Mrs. Brandegee, August 4, 1905.

13. HEMIZONIA

1. **Hemizonia Wheeleri** Gray, Bot. Calif., vol. 1, p. 617. 1876.

Madia tenella Greene, Pitt., vol. 3, p. 167. 1897.

Type locality.—"Tulare Co., Monachay meadows, etc., upper part of South Fork of Kern River, at 8,200 to 10,000 feet altitude."

Range.—Southern Sierra Nevada and mountains of southern California.

Zone.—Transition, rising into the Canadian.

Specimens examined.—Monache meadow, 8,200 feet, Rothrock 306; Mt. Olancha, 10,000 feet, Rothrock 335; same locality, on Summit meadow, 9,500 feet, Hall and Babcock 5276; sandy places near Soda Creek, 8–9,000 feet, Purpus 5071.

14. HELENIUM

Leaf bases decurrent upon the stem forming wings; tube of corolla very short or ring-like .... 1. **H. Bigelovii**
Leaf bases not decurrent; tube of corolla long .... 2. **H. Hoopesii**

1. **Helenium Bigelovii** Gray, Pac. R.R. Rep., vol. 4, p. 107. 1857.

Heleniastrum Bigelovii Kuntze, Rev. Gen. Pl., vol. 1, p. 342. 1891.

Type locality.—"Swamps near Santa Rosa Creek, California." *Bigelow.*

Range.—Southern Oregon through the Coast Ranges and the Sierra Nevada to the mountains of southern California.

Zone.—Transition mainly, rising into the Canadian.

Specimens examined.—Cisco, Brandegee; Glen Alpine, Setchell and Dobie, July 6–21, 1901; Lily Lake, Tahoe, 6,600 feet, Smiley 327; Mt. Raymond, Madera County, 7,800 feet, Smiley 532; soda spring, north fork of Kern River, 8,500 feet, Rothrock 414; Little Kern River, 9,000 feet, Culbertson (B 4273); meadows near Little Kern

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* The species, *H. minima* Gray (Proc. Am. Acad., vol. 9, p. 189. 1874) is a common Transition plant, from which the variety differs in the achene of the ray being beaked, but forms difficult of assignment occur, as my no. 737 shows an intermediate condition between the species and the higher mountain variety.

River, 9–10,000 feet, Purpus 5187; near Mineral King, Tulare County, 8,000 feet, Hall and Babcock 5672; Alta meadows, Tulare County, R. Hopping 501.

Most of the Sierran material differs from Bigelow's type in the greater amount of the pubescence, which is somewhat scabrid, also in the foliage being slightly succulent; these differences Dr. Greene considered sufficiently marked to separate *Heleniastrum rivulare* (Fl. Fran., p. 435. 1897), but Dr. H. M. Hall has pointed out[122] the inconstant nature of these characters.

2. **Helenium Hoopesii** Gray, Proc. Acad. Phila., 1863, p. 65. 1864.

Heleniastrum Hoopesii Kuntze, Rev. Gen. Pl., vol. 1, p. 342. 1891.
Dugaldea hoopesii (Gray) Rydb., Mem. N. Y. Bot. Gard., vol. 1, p. 425. 1900.

Type locality.—"South Park and west of Pike's Peak," Colorado.

Range.—Rocky Mountains from Montana to New Mexico and west to Oregon and California.

Zone.—Canadian, rising into the Hudsonian.

Specimens examined.—Sonora Pass, Bolander 6157; same locality, Brewer 1902; Dog Lake, near Tuolumne meadows, 9,300 feet, Smiley 844; South Fork of Kern River, 9–10,000 feet, Rothrock 352; meadows near Little Kern River, 9–10,000 feet, Purpus 5190; Andrew's Camp, Bishop Creek, Inyo County, A. Davidson 2595; Langley's Camp, Mt. Whitney, 11,700 feet, Hall and Babcock 5548; Mt. Olancha, Tulare County, 8,200 feet, Hall and Babcock 5520.

15. ERIOPHYLLUM

Rays 5–6, short and inconspicuous; low annual, 2–6 inches high, with short pedunculate heads .... 1. **E. nubigenum**
Rays 8–12, longer and obvious; perennial with solitary, long-peduncled heads .... 2. **E. lanatum**

1. **Eriophyllum nubigenum** Greene, *in* Gray, Proc. Am. Acad., vol. 19, p. 25. 1883.

Type locality.—"On Cloud's Rest, above the Yosemite, at 9,000 feet."

Range.—Yosemite region of the Sierra Nevada.

Zone.—Hudsonian?

Specimens examined.—Cloud's Rest, 9,000 feet, K. Curran, July, 1883; Yosemite, Mrs. Dodd, July, 1891.

2. **Eriophyllum lanatum** (Pursh.) Forbes, Hort. Woburn., p. 183. 1833.

Actinella lanata Pursh, Fl., p. 560. 1814.

Type locality.—"On the high lands of the Kooskoosky (Idaho)."

Range.—British Columbia to Montana, south to Wyoming and California.

Zone.—Transition and Canadian.

Specimens examined.—Grass Lake, Miss Lathrop, July 19, 1909; south of snow sheds at Cisco, 6,000 feet, Hall 8755; Cisco, Miss H. A. Walker 1450.

2a. **Eriophyllum lanatum** var. **integrifolium** (Hook.), comb. nov.

Trichophyllum integrifolium Hook., Fl. Bor. Am., vol. 1, p. 316. 1833.
Bahia integrifolia DC., Prodr., vol. 5, p. 656. 1836.
E. caespitosum var. *integrifolium* Gray, Proc. Am. Acad., vol. 19, p. 26. 1883.
E. integrifolium Greene, Fl. Fran., p. 444. 1897.
E. lutescens Rydb., N. Am. Fl., vol. 34, p. 87. 1915.
E. monoense Rydb., *l.c.*

Type locality.—"With the preceding" on the "Kooskoosky River."

Range.—Idaho to California; perhaps coextensive with the species.

Zone.—Transition to above timber line in rocky places.

Specimens examined.—Mt. Rose, 9,700 feet, Heller, August 28, 1911; Cisco Butte, 6,400 feet, Hall 8753a; above Heather Lake, Tahoe, Setchell and Dobie, July 6–21, 1901; foot of Dicks Peak, Tahoe, 8,600 feet, Smiley 425; Sonora Pass, dry summit of the pass, Brewer 1900; Silver Mountain, Alpine County, 10–11,000 feet, Bolander 2688; Mt. Dana, 11,100 feet, Smiley 714; Cloud's Rest, Yosemite, Chesnut and Drew, July 10, 1889.

The variety differs from the species in having the leaves nearly entire, a few usually completely so in some plants, though, as a rule, the apex at least is distinctly lobed. The white woolly indument characteristic of this species is often so reduced in amount as to make the stems and leaves appear green rather than the typical cottony color. The several different aspects have been assigned specific values in the *North American Flora*.

16. HULSEA

Leaves radical, the stems scapose or (in *H. vestita* var. *pygmaea*) obsolete, with a few bract-like leaves.
  Rays 20–30 or sometimes fewer or wanting, short; plants permanently white tomentose ....1. **H. vestita**
  Rays numerous (60–100), long and narrow, conspicuous; tomentum caducous ....2. **H. algida**
Stems leafy to the top: no white tomentum, the stems and foliage glandular; rays broad and showy ....3. **H. brevifolia**

1. **Hulsea vestita** Gray, Proc. Am. Acad., vol. 6, p. 547. 1866.

Type locality.—''In dry volcanic ashes, near the summit of a volcanic hill south of Lake Mono, alt. about 9,000 feet.''

Range.—Sierra Nevada and San Bernardino Mountains of California, and in southwest Nevada.

Zone.—Transition and Canadian.

Specimens examined.—Volcanic hill south of Mono Lake, 9,000 feet, Brewer 1824; Upper San Joaquin, Madera County, Congdon, August 19, 1895; soda springs of the San Joaquin, Congdon, August 16, 1899; Olancha Mountain, Tulare County, 9,500 feet, gravel slopes, Hall and Babcock 5263.

1a. **Hulsea vestita** var. **pygmaea** Gray, Syn. Fl., vol. 1, pt. 2, p. 343. 1884.

Type locality.—''San Bernardino Co., on the summit of Grayback Mountain.''

Range.—Southern Sierra Nevada and San Bernardino Mountains.

Zone.—Canadian to Arctic-alpine.

Specimen examined.—Sandy plains near Mt. Whitney, 10–12,000 feet, Purpus 1598.

This variety differs in having the heads sessile in the radical tuft of leaves and the rays of a deeper hue than in the type.

2. **Hulsea algida** Gray, Proc. Am. Acad., vol. 6, p. 547. 1865.

H. caespitosa A. Nels. and Kennedy, Proc. Biol. Soc. Wash., vol. 19, p. 38. 1906.

Type locality.—''High peaks of the Sierra Nevada, on Mount Dana, at 11,500 feet, and Wood's Peak, 10,500 feet.''

Range.—Central and southern Sierra Nevada; also in the Wallowa Mountains of eastern Oregon.

Zone.—Arctic-alpine.

Specimens examined.—Mt. Rose, 10,800 feet, Heller 9865; same locality, 10,800 feet, Kenndey 1158;* Mt. Dana, east side of north ridge overlooking Mono Lake, 12,200 feet, Smiley 730; same locality, at summit, Chesnut and Drew, July 17, 1889; Wood's Peak near Amador Pass, 10,500 feet, Brewer 2120; top of Mt. Lyell, Muir in 1872; Mt. Goddard, 13,000 feet, Hall and Chandler 667; summit of Cirque Peak, 12,942 feet, Hall and Babcock 5497; above timber line on mountain north of Whitney meadows, Coville and Funston 1660; Mt. Whitney, 13,700 feet, Rothrock 387; slopes of Old Mt. Whitney, 12–13,000 feet, Purpus 1421; rocky slopes on Little Kern River, 11–12,000 feet, Purpus 5196.

3. **Hulsea brevifolia** Gray, Proc. Am. Acad., vol. 7, p. 359. 1867.

Type locality.—"Mariposa Big-tree Grove."

Range.—Sierra Nevada.

Zone.—Transition and Canadian.

Specimens examined.—Near Cloud's Rest, Chesnut and Drew, July 10, 1889; base of Cloud's Rest, Congdon, August 5, 1898; Snow Creek, Yosemite, 7,000 feet, Hall 9181; Yosemite Creek to Porcupine Flat, 7,500 feet, Hall and Babcock 3466; foot of Cloud's Rest, 8,100 feet, Smiley 509; Buck Camp, Mariposa County, Congdon, August 15, 1895.

17. OROCHAENACTIS

1. **Orochaenactis thysanocarpha** (Gray) Coville, Contr. Nat. Herb., vol. 4, p. 134. 1893.

Chaenactis thysanocarpha Gray, Proc. Am. Acad., vol. 19, p. 30. 1883.
Bahia Palmeri Wats., Proc. Am. Acad., vol. 24, p. 83. 1889.

Type locality.—"Southern part of the Sierra Nevada, California, probably in Kern Co., at 9,800 feet."

Range.—Southern Sierra Nevada.

Zone.—Upper Transition and lower Canadian.

Specimens examined.—Sandy places in forest of *Pinus Jeffreyi* on Soda Creek, Tulare County, 7–8,000 feet, Purpus 5218; Long meadow, Tulare County, Dr. E. Palmer 168; sandy plains, Whitney meadows, Tulare County, 9–10,000 feet, Purpus 1639.

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* This collection furnished the basis for *H. caespitosa*.

18. CHAENACTIS

Leaves large, deltoid in outline, 3–4 inches broad; scapes several headed; plant 8 inches–2 feet high ....1. **C. Douglasii**

Leaves very small; scapes monocephalous; plant 2–4 inches high. 2. **C. nevadensis**

1. **Chaenactis Douglasii** (Hook.) Hook. and Arn., Bot. Beech., p. 354. 1840.

Hymenopappus Douglasii Hook., Fl. Bor. Am., vol. 1, p. 316. 1833.
Macrocarpus Douglasii Nutt., Trans. Am. Phil. Soc. II, vol. 7, p. 376. 1841.
C. rubricaulis Rydb., N. Am. Fl., vol. 34, p. 72. 1914.

Type locality.—"On the barren dry sandy grounds of the Columbia, from the 'Great Falls' to the Rocky Mountains."

Range.—Washington east to Montana and south to California and New Mexico.

Zone.—Transition, rising into the Canadian.

Specimens examined.—Glen Alpine, Tahoe, McGregor 26; Fallen Leaf near shore of lake, Miss Lathrop, July 12, 1909; Silver Lake, Amador County, 8,000 feet, Hansen 271; Deer Park, Placer County, 1,970 m., Miss H. A. Walker 2170*; east side of Ralston Peak, Tahoe, 7,900 feet, Heller 12534; Tuolumne meadows, Yosemite, 8,750 feet, R. A. Ware 2650c; region of Dinkey Creek, Fresno County, 7,000 feet, Hall and Chandler 4201; trail to Mt. Whitney, Tulare County, 10,600 feet, Culbertson (B 4418); Olancha Mountain, Tulare County, 9,000 feet, Hall and Babcock 5266.

2. **Chaenactis nevadensis** (Kellogg) Gray, Bot. Calif., vol. 1, p. 391. 1876.

Hymenopappus Nevadensis Kellogg, Proc. Calif. Acad. I, vol. 5, p. 46. 1873.
C. Douglasii var. *alpina* Gray, Syn. Fl., vol. 1, pt. 2, p. 341. 1884.
C. Douglasii var. *montana* Jones, Proc. Calif. Acad. II, vol. 5, p. 700. 1895.
C. pumila Greene, Leaflets, vol. 2, p. 223. 1912.

Type locality.—Not given.

Range.—Washington to California and east on the ranges of the Great Basin to western Colorado.

Zone.—Arctic-alpine, coming down infrequently into the Hudsonian.

Specimens examined.—Mountains above Coldstream, 8,000 feet, Sonne, August, 1887; Summit, Kellogg in 1870; Tinker's Knob, Placer County, 8,500 feet, Sonne, August, 1887; high ridge above Donner

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* This collection presents a plant with scapes and leaf petioles tinged with red, as is often the case with high mountain plants. It is made the basis for *C. rubricaulis.*

Pass, 8,500 feet, Heller 7152; Pyramid Peak, 9,400 feet, Hall and Chandler, 4750; above Heather Lake, Tahoe, 8,400 feet, Smiley 352; Silver Mountain Pass, Alpine County, Hooker and Gray in 1877; peak near Sonora Pass, 11,500 feet, Brewer 1901, July 18, 1863; head of the San Joaquin River, dry sand at 10,000 feet, Muir 2 in 1873; Alta meadows, Tulare County, Mrs. Brandegee, August, 1905; same locality, Hopping 523; Old Mt. Whitney, rocky places at 12–13,000 feet, Purpus 1589.

Dr. Gray, in describing the var. *alpina,* clearly recognized its doubtful character, as distinct from *C. nevadensis,* and the collections made since demonstrate the impossibility of maintaining it apart from the latter species. The extension of the range of the species to Washington is based upon Professor Piper's identification of *Brandegee* 906 from Mt. Stuart; this collection is the only one reported north of the southern Cascades.

The reference to the synonymy of *C. nevadensis* of *C. Douglasii* var. *montana* Jones is based upon description only. If there are plants within the Sierra, which justify the segregation, they have not come to my notice. This variety is said by its author to include "most of the forms usually referred to the var. *alpina* of Gray.... This is the usual form of the higher mountains, from 7,000 ft. to 9,000 ft. alt., and ranges from the Rocky Mountains of Colorado to the Sierras." It is referred by Rydberg (N. Am. Fl., vol. 34, p. 72) to the synonymy of *C. pedicularia* Greene (by error called "*peduncularia*"), a species described (Pitt., vol. 4, p. 98. 1899) from the mountains of southern Colorado and considered by Professor Aven Nelson (Coulter-Nelson *New Manual,* p. 557) to be indistinguishable from the var. *alpina* Gray.

19. RAILLARDELLA

Plant silvery canescent; scapoid peduncles 1–4 inches high ....1. **R. argentea**
Plant strigose pubescent, glabrate, never silvery; peduncles 4–10 inches high ....2. **R. scaposa**

1. **Raillardella argentea** Gray, Bot. Calif., vol. 1, p. 417. 1876.

Raillardia argentea Gray, Proc. Am. Acad., vol. 6, p. 555. 1865.

Type locality.—"Sonora Pass, 8,000–10,000 feet, and Ebbett's Pass, at about the same altitude, on dry slopes."

Range.—Sierra Nevada and San Bernardino Mountains (Mt. San Gorgonio). White Mountains of Inyo County. Also Mt. Lassen, and (acc. Howell) at Crater Lake, southern Oregon.

Zone.—Arctic-alpine, rarely lower.

Specimens examined.—Castle Peak near the highest point, Heller, August 3, 1903; Pyramid Peak, Tahoe, 8,900 feet, Hall and Chandler 4746, and at 9,600 feet, no. 4721; Ebbett's and Sonora Passes, Brewer 1897, 1986, 2686; near snow above Donner Lake, E. L. Greene 396; Mt. Gibbs, Yosemite, 10,600 feet, Smiley 787; Mt. Goddard, 11,500 feet, Hall and Chandler 698; Alta Peak, Tulare County, R. Hopping 89; Kaweah Peak, Tulare County, 12–13,000 feet, Purpus 1445; near Kearsarge Pass, Tulare County, S. W. Austin 556; Denel's Peak, Tulare County, 10,500 feet, Hall and Babcock 5517.

2. **Raillardella scaposa** Gray, Bot. Calif., vol. 1, p. 417. 1876.

Raillardia scaposa Gray, Proc. Am. Acad., vol. 6, p. 551. 1865.
Raillardella scaposa var. *Eisenii* Gray, Syn. Fl., vol. 1, pt. 2, p. 380. 1884.
Raillardella nevadensis A. Nels. and Kennedy, Proc. Biol. Soc. Wash., vol. 19, p. 38. 1906.

Type locality.—"On a peak of the Sierra Nevada, N.N.E. of Soda Springs, in sunny places, at an elevation of 10,000 feet."

Range.—Sierra Nevada, as to the typical form.

Zone.—Hudsonian and Canadian.

Specimens examined.—Sentinel Dome, Yosemite, Hooker and Gray in 1877; back of Sentinel Dome, 8,000 feet, A. Gray in 1872; Eagle Peak, Yosemite, Chesnut and Drew, July 6, 1889; peak above Lake Tenaya, Yosemite, 8,900 feet, Smiley 872; Mono Trail Bolander 5099; Tuolumne meadows, 8,500 feet, Smiley 829; vicinity of Lake Tenaya, 8,300 feet, Hall and Babcock 3504; peak N.N.E. of Soda Springs, 10,000 feet, Brewer 1796; Bald Mountain, Fresno County, 8,500 feet, Hall and Chandler 384; Kaiser Crest, Fresno County, 9,000 feet, Smiley 649; mountains of Kings River Region, Fresno County, Dr. G. Eisen in 1879; Alta meadows, Tulare County, R. Hopping, 522; Farewell Gap, Tulare County, Culbertson (B 4529); same locality, 9–10,000 feet, Purpus 5136; Mt. Rose, Carson Range, Nevada, 10,000 feet, Kennedy 1147; rocky mountain slopes on Little Kern River, Tulare County, 11–12,000 feet, Purpus 5660.

At the highest stations this species assumes a creeping habit, illustrated by *Kennedy* 1147 and this aspect is the basis for *R. nevadensis,* a strictly ecologic variation but described as a species "Abundant in loose granite sand on Mount Rose, Washoe County, Nevada, at 10,000 feet."

Raillardella is a genus peculiar to California, having, besides the two species here listed, three others: *R. Muirii* Gray of the Sierra

(Transition zone), *R. scabrida* Eastwood of the Coast Ranges, and *R. Pringlei* Greene of the mountains of northern California, the latter species being, however, very doubtfully distinct from *R. scaposa.*

20. ARNICA

Leaves uniform in shape; all narrowed to a petiole (usually winged) or sessile.
  Hears large (involucres ½–¾ inch high), solitary or few (2–3), on long leafless peduncles .... 1. **A. nevadensis**
  Heads medium sized (involucres ⅜–½ inch high), usually several on peduncles with 3 or more pairs of leaves which are not much diminished in size upward.
    Plants whitened with soft floccose tomentum; lower leaves with connate bases sheathing the stems and palmately nerved with 3 or 5 principal nerves .... 2. **A. foliosa** var. **incana**
    Plants green; leaves pinnately veined.
      Stems numerous, clustered; leaves narrow (⅜–¾ inch wide), 3–6 inches long, lanceolate-acuminate, widest in the middle; achenes minutely glandular but not hairy .... 3. **A. longifolia**
      Stems solitary or few; leaves broader (⅝–¾ inch wide), oblong lanceolate to ovate, obtuse or only acute; achenes hairy, at least at first.
        Leaves entire to repand dentate, soft pubescent .... 4. **A. mollis**
        Leaves saliently and acutely dentate, nearly glabrous above and often glandular .... 5. **A. amplexicaulis**
Leaves of 2 kinds: the upper cauline sessile, lanceolate; the usually obtuse lower leaves petioled and cordate or subcordate at base.
  Plants with harsh, viscid-glandular pubescence or nearly glabrous; lower leaves sharply dentate, short petioled; heads larger than in the next .... 6. **A. latifolia** var. **viscidula**
  Plants with hirsute or villous pubescence, not viscid-glandular; lower leaves serrate or dentate .... 7. **A. cordifolia**

1. **Arnica nevadensis** Gray, Proc. Am. Acad., vol. 19, p. 55. 1884.

Type locality.—"California, collected several years ago on Lassen's Peak."

Range.—Sierra Nevada and northward to the mountains of Lassen County and perhaps in the Mt. Shasta region.

Zone.—Canadian mainly, but found both above in the Hudsonian and rarely below in the Upper Transition.

Specimens examined.—Mt. Stanford (Castle Peak), 8,400 feet, Sonne, July 17, 1887; same locality, Dr. Kellogg, July 29, 1870; Glen Alpine, Tahoe, Setchell and Dobie, July 6–21, 1901; about Fallen Leaf Lake, Tahoe, M. S. Baker, July 3, 1904; near Suzy Lake, Tahoe, 7,900 feet, Smiley 168; Mt. Tallac, gravel among rocks to summit, Hall and Chandler 4613; head of Fall Creek, Ormsby County, Nevada, 2,460 m., Baker 1432; Rubicon Peak, Tahoe, 8,700 feet, Smiley 403; Angora Peaks, Tahoe, 7,500 feet, Hall 8796; Carson Spur, Alpine County, 8,500 feet, Hansen 410; Mt. Dana, 10,000 feet, Hall and Babcock 3599; peak N.E. of soda springs, Tuolumne River, 9–10,000 feet, State Survey 1808.

2. **Arnica foliosa** Nutt. var. **incana** Gray, Bot. Calif., vol. 1, p. 416. 1876.

A. incana Greene, Pitt., vol. 4, p. 169. 1900.
A. cana Greene, Ottawa Nat., vol. 15, p. 282. 1902.

Type locality.—"Lake Tahoe," California.

Range.—California to Washington.

Zone.—Transition and Canadian.

Specimens examined.—Holcomb Lake, Washoe County, Nevada, 8,000 feet, Kennedy 1870; Lake Tahoe, Brewer 2148 (type); Summit, M. K. Curran, August, 1883; Lake Valley, Tahoe, 6,400 feet, Abrams 4812; Lake Tenaya, Yosemite, 8,200 feet, Hall and Babcock 3515; Tuolumne River, 9,700 feet, Bolander 5065.

Coville refers here *Coville and Funston* 1638 from above Whitney meadows, Tulare County.[50]

3. **Arnica longifolia** D. C. Eaton, *in* Wats., Bot. King's Exped., p. 186. 1871.

Type locality.—"In dense clumps among rocks, Clover Mountains, Nevada, and in the Uintas above Bear River Cañon; 10,000 feet altitude."

Range.—Sierra Nevada east to Colorado and north to Montana and British Columbia.

Zone.—Canadian.

Specimens examined.—Mt. Rose, 9,650 feet, Heller 9961; mountains above Coldstream, Placer County, Sonne, August 7, 1887; Nevada County, 7,000 feet, A. M. Carpenter, August-September, 1893; Sierra Nevada above Summit Station, Pringle, September 25, 1882; between Suzy and Heather lakes, Tahoe, 8,100 feet, Smiley 184; Ralston Peak, Tahoe, 8,100 feet, Smiley 413; Glen Alpine, Tahoe, 7,200 feet, Hall 8815; Carson Spur, Alpine County, 8,500 feet, Hansen 786; Heather Lake, Tahoe, 7,900 feet, Hall 8825; Mount Raymond, Madera County, 8,000 feet, Smiley 540; wet places on Little Kern River, Tulare County, 9,400 feet, Purpus 2025; South Fork of Kern River, 9,800 feet, Rothrock 347.

4. **Arnica mollis** Hook., Fl. Bor. Am., vol. 1, p. 231. 1839.

A. ovata Greene, Pitt., vol. 4, p. 161. 1900.
A. tomentosa Rydb., Bull. Torr. Bot. Club, vol. 28, p. 20. 1901.
A. rhizomata A. Nels., Bot. Gaz., vol. 31, p. 409. 1901.

Type locality.—"Alpine rivulets of the Rocky Mountains."

Range.—British Columbia to eastern Quebec and south to New Hampshire, Colorado, Utah, and California.

Zone.—Canadian and Hudsonian.

Specimens examined.—Sierra Nevada, Brandegee; Summit Valley, 8,000 feet, Pringle, September 23, 1882; rocky height above Coldstream, Nevada County, 8,000 feet, Sonne, August 12, 1888; Castle Peak near the highest point, 9,000 feet, Heller 7098; Mt. Rose, 10,000 feet, Kennedy 990; Castle Peak trail, 8,300 feet, Smiley 489; Glen Alpine Creek, Tahoe, 7,700 feet, Hall 8816*; Maggie's Peaks, Tahoe, 7,100 feet, Hall 8811; moist open ground near Donner Lake, E. L. Greene 475; Velma Lakes, Tahoe, 8,000 feet, Hall 8807; Cloud's Rest, Yosemite, 8,100 feet, Smiley 510; Mt. Dana, Bolander 6134; east side of Lake Tenaya, Yosemite, 8,300 feet, Smiley 685;* North Fork of the Kaweah, Tulare County, Culbertson (B 4521);* Alta meadows, Tulare County, Mrs. Brandegee, August 6, 1905; Mt. Silliman, Tulare County, Mrs. Brandegee, August, 1905.

4a. **Arnica mollis** var. **scaberrima** (Greene), comb. nov.

A. scaberrima Greene, Pitt., vol. 4, p. 165. 1900.

Type locality.—"From Little Kern Fiver, at an altitude of 9,000 to 10,000 feet."

Range.—Probably coincident with that of the species; only specimens from the Sierra have been carefully compared by me.

Zone.—Hudsonian?

Specimens examined.—Half-Moon Lake, Tahoe, 8,200 feet, Hall and Chandler 4701; moist places near Little Kern River, Tulare County, 9–10,000 feet, Purpus 5260.

The form of the species, here accepted as the var. *scaberrima,* differs from the typical state in having the usually soft pubescence replaced by short scabrid hairs, the plants becoming harsh to the touch, and also by the leaves becoming more or less saliently toothed and so approaching the following species.

5. **Arnica amplexicaulis** Nutt., Trans. Am. Phil. Soc. II, vol. 7, p. 408. 1841.

Type locality.—"On the rocks of the Wahlamet at the Falls," Oregon.

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* These collections present plants conforming to the description of *A. subplumosa* Greene (Pitt., vol. 3, p. 104. 1898), a species described from the mountains of Colorado and presumed to differ from *A. mollis* by the pappus hairs being somewhat plumose. The unsubstantial nature of the basis for this description has been indicated by Dr. Rydberg (Bull. Torr. Bot. Club, vol. 37, p. 461).

Range.—Pacific Coast from Washington to the southern Sierra Nevada.

Zone.—Canadian mainly, but occurring in the Transition.

Specimens examined.—Collins meadow, Fresno County, 7,300 feet, Hall and Chandler 446; South Fork of the San Joaquin, 8,600 feet, Hall and Chandler 649.

6. **Arnica latifolia** Bong. var. **viscidula** Gray, Syn. Fl., vol. 1, pt. 2, p. 381. 1884.

Type locality.—"High Sierra Nevada, California."

Range.—Sierra Nevada, in the northern half; perhaps far to the northward.

Zone.—Canadian.

Specimens examined.—Near Soda Springs, 7,100 feet, Smiley 456; Donner Pass, Heller 7029; Sierra Nevada, 9,000 feet, Pringle, September 25, 1882; near Summit, E. L. Greene 414; Frog Lake, Mt. Stanford (Castle Peak), Sonne, July, 1890.

According to Dr. Rydberg (Bull. Torr. Bot. Club, vol. 37, p. 462. 1910), the above variety is equivalent to *A. diversifolia* Green (Pitt., vol. 4, p. 171. 1900), described from "northward slopes of the highest Powder River Mountains, eastern Oregon, at 8,000 to 9,000 feet," and based upon a collection by Cusick (no. 1810), which I have had no opportunity of seeing. The identity is by no means unlikely since many of the species ranging from Alaska through British Columbia and Washington to the Rockies of Wyoming and Colorado, the range of typical *A. latifolia* Bong., and having peculiar varieties in the Californian region, have the geographical point of incidence of species and variety in the mountains of northeastern Oregon.

7. **Arnica cordifolia** Hook., Fl. Bor. Am., vol. 1, p. 331. 1833.

Type locality.—"Alpine woods of the Rocky Mountains, on the east side, *Drummond;* and on the west side in mountain woods between the Kettle Falls and Spokane River, and in the Blue Mountains, *Douglas.*"

Range.—British Columbia to California and New Mexico; in the north eastward at least as far as Lake Superior.

Zone.—Transition and Canadian.

Specimens examined.—Mt. Rose, 9,650 feet, Heller 9893; Sierra County, Lemmon in 1874; Rubicon Peak, Tahoe, 8,000 feet, Smiley

401; South Fork of the San Joaquin River, 9,000 feet, Hall and Chandler, July, 1900; moist places near Soda Creek, Tulare County, 8–9,000 feet, Purpus 1811.

21. SENECIO

- Stems leafy up to the inflorescence, the leaves all alike, dentate and glabrous.
  - Stems low (not exceeding 1 foot high); leaves thick, ovate-spatulate to oblong, coarsely toothed above the middle; heads few or solitary, somewhat long-peduncled .... 1. **S. Fremontii** var. **occidentalis**
  - Stems taller (2–5 feet high) and usually simple; leaves very thin or membranous, yellowish-green, deltoid or hastate, toothed from the base; heads numerous, disposed in a corymbiform cyme .... 2. **S. triangularis**
- Stems appearing scapose, the foliage composed of larger basal leaves, the upper cauline reduced or wanting and the inflorescence naked.
  - Leaves all entire or few toothed, never pinnatifid.
    - Leaf blades ⅜–1.25 inches long; stems 2–15 inches high; petioles not winged .... 3. **S. oreopolus**
    - Leaf blades much longer (3–4 inches) and stems taller, commonly solitary; leaves spatulate, narrowing to winged petioles.
      - Stems from rootstocks; leaves strictly basal, serrate; heads small.
        - Leaves and stems with more or less white tomentum .... 4. **S. scorzonella**
        - Leaves and stems early becoming glabrate .... 5. **S. Covillei**
      - Stems from a fascicle of fibrous roots and bearing leaves to about the middle; leaves denticulate or almost entire; heads of good size .... 6. **S. lugens** var. **exaltatus**
  - Leaves pinnatifid (species allied to *S. aureus* L.).
    - Stems several, 1 foot or taller; cauline leaves reduced but showing evident blades; heads several to many.
      - Leaves thin or membranous, the basal on petioles no longer than the blades; heads usually rayless, orange yellow in color .. 7 **S. pauciflorus**
      - Leaves thickish, the basal long petioled; heads radiate; the rays lemon yellow .... 8. **S. laetiflorus**
    - Stems solitary; the upper leaves reduced to bracts; heads small and solitary or 2 or 3 .... 9. **S. subnudus**

1. **Senecio Fremonti** T. and G., var. **occidentalis** Gray, Bot. Calif., vol. 1, p. 618. 1876.

Type locality.—"Sierra Nevada, on Mount Whitney at 12,500 feet, and S. Fork of Kern River down to 9,800 feet."

Range.—Pacific Coast from Washington to California.

Zone.—Hudsonian and arctic-alpine; occasionally in the Canadian.

Specimens examined.—Mt. Rose, 10,500 feet, Heller 9914; Bloody Cañon, Mono County, Chesnut and Drew, July 20, 1889; Inyo County, S. W. Austin 337; Yosemite Park, J. B. Lembert 1001;[*] Kaiser Crest,

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[*] Dr. Greene considered the Sierran material, here referred to the var. *occidentalis*, to be specifically distinct from the typical form present in the Rocky Mountains (see Pitt., vol. 4, p. 122. 1900) and assigned as distinguishing characters, longer and narrower glabrous achenes as contrasted with shorter pubescent achenes for the typical form; examination of such material as came to my notice failed to bear out the statement as to the relative length of the achenes but there does seem to be general agreement among the West Coast specimens in the matter of the hairiness of the achenes: these in the Sierran collections, and the same is true for the Oregon and Washington collections seen by me, are usually glabrous, but not exclusively so, for Lembert's plant, cited above, shows some achenes with a sparse hispid pubescence.

Smiley 642; Mt. Silliman, Tulare County, Mrs. Brandegee, August 6, 1905; rocks above Alta meadows, Tulare County, Mrs. Brandegee, August 6, 1905; Coyote Creek, Tulare County, Culbertson (B 4444); Hockett's meadows, Tulare County, 8,500 feet, H. M. and G. R. Hall 8469; gravelly mountain slopes, Upper Little Kern River, 10–11,000 feet, Purpus 5195; Mt. Whitney, 13,000 feet, Hall and Babcock 5533; Cirque Peak, 10,500–12,800 feet, Hall and Babcock 5508; Mt. Guyot, 11,800 feet, H. M. and G. R. Hall 8428.

Fresno County, 9,800 feet, Smiley 637; Kaiser Peak, 10,100 feet,

2. **Senecio triangularis** Hook., Fl. Bor. Am., vol. 1, p. 332, t. 115. 1834.

S. trigonophyllus Greene, Pitt., vol. 3, p. 106. 1896.
S. triangularis Hook. var. *Hanseni* Greene, Erythea, vol. 3, p. 124. 1895.

Type locality.—''Moist prairies among the Rocky Mountains.''

Range.—British Columbia to Saskatchewan and south to southern California and New Mexico.

Zone.—Canadian mainly, but occurring in the Hudsonian and infrequently in the Transition.

Specimens examined.—Castle Peak, meadow at 8,400 feet, Smiley 476; Mt. Rose, 9,500 feet, Heller 10334; same locality, 10,000 feet, Kennedy 1175; Heather Lake, Tahoe, 7,900 feet, Hall 8826; Glen Alpine, Tahoe, Setchell and Dobie, July 6–21, 1901; Gilmore Lake, Tahoe, C. J. Fox Jr., July, 1895; Silver Lake, Amador County, 7,200 feet, E. Mulliken 131, 135; Andrews Camp, Inyo County, A. Davidson 2605; soda springs of the Tuolumne, Yosemite, J. B. Lembert, July-August, 1894; Mt. Silliman, Tulare County, Mrs. Brandegee, August 23, 1905; Hockett's meadows, Tulare County, Culbertson (B 4317); Coyote Creek, Tulare County, Culbertson (B 4336); Mineral King, Tulare County, T. S. Brandegee, July 27, 1892.

3. **Senecio oreopolus** Greenm., Monogr. Senecio, pt. 1, p. 24. 1901 (nomen nudum); Ann. Mo. Bot. Gard., vol. 1, p. 268, pl. 11. 1914.

S. canus Gray, Bot. Calif., vol. 1, p. 412. 1876, in part; not Hook.
S. kernensis Greenm., Monogr. Senecio, Pt. 1, p. 24. 1901 (nomen nudum); Ann. Mo. Bot. Gard., vol. 1, p. 266. 1914.

Type locality.—''Rock Creek Cañon, basin of the Upper Kern River, Tulare Co., altitude 3050 m.''

Range.—Sierra Nevada, central and southern part.

Zone.—Hudsonian and Arctic-alpine.

Specimens examined.—Castle Peak, near the highest point, 9,000 feet, Heller 7102; Silver Mountain, Alpine County, 10–11,000 feet, Bolander 2686; base of Mt. Gibbs, Yosemite, 10,000 feet, Smiley 763; same locality, north side at 11,000 feet, Smiley 773; dry hilltop near Ebbett's Pass, 8,500–9,500 feet, Brewer 2005; peak near Sonora Pass, 11,500 feet, Brewer 1905;* Mt. Dana, above timber line, E. B. Babcock, August, 1915; same locality, 11,750–12,200 feet, Hall and Babcock 3613; dry slopes near the summit of Sonora Pass, 11,500 feet, State Survey 1904; near Lundy, Mono County, 8–9,000 feet, Miss M. Minthorn 17;* Bloody Cañon, on dry ledges, 8,500 feet, R. A. Ware 2641c;* Kaiser Peak, Fresno County, 9,800 feet, Smiley 636; Andrew's Camp, Inyo County, A. Davidson 2573; Rock Creek Cañon, 10,000 feet, Tulare County, Hall and Babcock 5526 (cotype); Whitney meadows, Tulare County, 10,000 feet, Mus. Vert. Zool. Exped., Aug. 17, 1911; rocky mountain slopes on Little Kern River, 10–11,000 feet, Purpus 5240; Toowa Range, Tulare County, in Indian Head Cañon, Hall and Babcock 5305.

Dr. J. M. Greenman considers such plants as are represented by *State Survey* no. 1904, which appears similar to several others of the collections cited (*Hall* and *Babcock* 3613; *Smiley* 773), to constitute a distinct species, *S. Muirii* Greenm. (Ann. Mo. Bot. Gard., vol. 5, p. 56. 1918), the type "Collected on Mount Dana, California, alt. 3,050–3,655 m." by the old State Survey. The reasons for separating these plants from the bulk of the Sierran material allied to *S. canus* Hook. (Fl. Bor. Am., vol. 1, p. 333, pl. 116. 1834) are not clear to me nor do they appear significant when the descriptions of *S. Muirii* and *S. oreopolus* are compared. Just what relation our Sierran plants, here accepted as constituting *S. oreopolus*, have to *S. canus* is still obscure. The bulk of our material shows certain differences from Hooker's figure, wherein the achene is represented as enlarging upward and hairy on the angles, while the Sierran plants consistently have the achene columnar, not enlarged upward, and entirely glabrous. Dr. Greenman, however, in describing *S. canus* (Monogr. in Ann., vol. 5, p. 74) says "achenes glabrous (notwithstanding original illustration." If this criticism of Hooker's figure is correct, the propriety of regarding our Sierran plants distinct from *S. canus* may well be called in question.

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* These collections present plants without rays as a rule. *Brewer* 1905 is the collection cited by Dr. Greenman as the type of the eradiate form, f. *aphanactis* Greenm. (*l.c.*, p. 269), but this form is impossible to maintain; the sheet of this number, preserved in the herbarium at Berkeley, shows both radiate and discoid heads on the same shoot.

4. **Senecio scorzonella** Greene, Pitt., vol. 3, p. 90. 1896.

Type locality.—Not given.

Range.—Southern Oregon, southern Idaho, and southward in the Warner Range of Modoc County, California, and the Sierra Nevada.

Zone.—Canadian.

Specimens examined.—About Marlette Lake, Washoe County, Nevada, 2,460 m., Baker 1385; shores of Heather Lake, Tahoe, 8,000 feet, Smiley 285; Desolation Valley, Tahoe, 8,600 feet, Smiley 97; Tuolumne meadows, Miss K. D. Jones 532; same locality, edge of forest, 8,500 feet, Smiley 753; Eagle Peak meadows, in firm sod, 7,200 feet, Hall 9204; Chilnualna trail, Mariposa County, Congdon, August (without year); Mt. Raymond, Madera County, 7,800 feet, Smiley 533; Alta meadows, Tulare County, Mrs. Brandegee, August 7, 1905; Mt. Silliman, Tulare County, Mrs. Brandegee, August 22, 1905.

5. **Senecio Covillei** Greene, Fl. Fran., p. 469. 1895.

Type locality.—"Near Whitney meadows in the southern Sierra."

Range.—Sierra Nevada.

Zone.—Canadian and Hudsonian.

Specimens examined.—Dry woods along the Tuolumne River, 9,700 feet, State Survey 5063; Tuolumne County, Chesnut and Drew; Hockett's meadows, Culbertson (B 4474); Guyot Creek, Tulare County, 10,500 feet, H. M. and G. R. Hall 8430; meadows near Farewell Gap, 10–11,000 feet, Purpus 5230.

6. **Senecio lugens** var. **exaltatus** Gray, Bot. Calif., vol. 1, p. 413. 1876.

Senecio exaltatus Nutt., Trans. Am. Phil. Soc., vol. 7, p. 410. 1841.
Senecio Sonnei Greene, Fl. Fran., p. 467. 1895.
Senecio columbianus Greene, Pitt., vol. 3, p. 170. 1897, at least as to our range.

Type locality.—"The plains of the Oregon, near the mouth of the Wahlamet."

Range.—Washington to California, east to the northern Rockies of Montana and Wyoming.

Zone.—Transition and Canadian, rarely above.

Specimens examined.—Cascade Mountains, Tahoe, Setchell and Dobie, July 6–21, 1901; Carson Spur, Alpine County, 8,500 feet, Hansen 418; Andrew's Camp, Inyo County, A. Davidson 2596, 2607; Dark Hole, Yosemite, 7,750 feet, H. M. Evans, July, 1901; Bierstadt

Peak, Tahoe, Davy 3187; southeastern approaches to Castle Peak, Heller 7068; dry ridges above Coldstream, Sonne, July, 1897; Tuolumne meadows, 8,500 feet, Smiley 754; Mt. Goddard, 11,100 feet, Hall and Chandler 681; Nellie Lake, Fresno County, 8,700 feet, Smiley 607; Hockett's meadow, Tulare County, Culbertson (B 4474); Alta meadows, Tulare County, G. B. Grant 3563.

The above synonymy has reference only to the Sierran representation of this variable species; definitive treatment of the many phases exhibited by the plant in different situations must be the work of some future monographer, though already it is evident that the above list of synonyms might be greatly extended.

7. **Senecio pauciflorus** Pursh., Fl. Am. Sept., vol. 2, p. 529. 1814.

S. Lemberti Greene, Pitt., vol. 3, p. 89. 1896.

Type locality.—"In Laborador."

Range.—Alaska to Laborador and south to Quebec, Great Lakes, Wyoming, and California.

Zone.—Canadian, perhaps to above timber line.

Specimens examined.—Trail to Castle Peak, 7,500 feet, Smiley 461; Yosemite National Park, J. B. Lembert, July 1895; soda springs of the Tuolumne, Yosemite, J. B. Lembert, August, 1894; high Sierra Nevada, W. G. Harford in 1890; Lake Sabrina, Bishop Creek, Inyo County, A. Davidson 2882.

The typical form of the species has discoid heads but occasionally plants show heads with more or less asymmetrical peripheral corollas, i.e., radiate heads are produced and constitute the var. *fallax* Greenm. (Contr. Nat. Herb., vol. 11, p. 597. 1906).

8. **Senecio laetiflorus** Greene, Pitt., vol. 3, p. 88. 1896.

Type locality.—"Near Boca," Nevada County, California.

Range.—Pacific Coast south of Washington; east to southwest Idaho and western Nevada.

Zone.—Transition and Canadian, the latter rarely.

Specimen examined.—Little Truckee River, Sierra County, 6,300 feet, Hall and Babcock 4526.

I am uncertain whether this species should be admitted to this list, since it is infrequent above the Transition. Following the description appears the note: "Common in grassy wet meadows along the eastern base of the Sierra Nevada, Calif."

9. **Senecio subnudus** DC., Prodr., vol. 6, p. 428. 1837.

Type locality.—"In Americae bor. ora occid. ad Columbia-river." *Douglas.*

Range.—British Columbia to Montana, south to Wyoming and California.

Zone.—Hudsonian and above timber line.

Specimens examined.—Plumas County, Mrs. Austin in 1876; Crane Flat, Yosemite, McLean, July, 1875; Mt. Dana, at timber line, 10,300 feet, Hall and Babcock 3619; summit of Mt. Dana, Lemmon in 1878.

Senecio werneriaefolius Gray (Proc. Am. Acad., vol. 19, p. 54. 1883), a species with determined range from the eastern side of the Rocky Mountains toArizona and appearing in the high mountains of Colorado and Arizona, has been reported[124] from the Sierra as growing in the alpine zone on Mt. Conness, north of Yosemite. Coville[50] referred nos. 1662 and 2052 of the Death Valley collection to this species. I have had no opportunity to examine these specimens but both of the Death Valley numbers are referred by Dr. Greenman to his *S. Muirii.*

According to Dr. Greenman,[123] *Senecio Suksdorfii* Greenm. (Bot. Gaz., vol. 53, p. 511. 1912) is represented in our region by Heller 9896 from "Mt. Rose, alt. 2,940 m." This is approximately 9,800 feet, but the sheet of this number preserved at the Gray Herbarium gives the station as "Mountains west of Carson, elevation 6,000 feet and the plant does not correspond to Howell's description (Fl. N.W. Am., vol. 1, p. 379. 1903, as *S. adamsii,* a name to be rejected as a homonym).

22. ACHILLEA

Involucral bracts pale, their margins scarcely darkened; pubescence of the leaves soft hirsute ....1. **A. millefolium** var. **lanulosa**
Involucral bracts with conspicuous dark brown-purple margins; pubescence of the leaves silky ....2. **A. borealis**

1. **Achillea millefolium** L. var. **lanulosa** (Nutt.) Piper, Fl. Palouse Reg., p. 196. 1901.

A. lanulosa Nutt., Jour. Acad. Phila., vol. 7, p. 36. 1834.
A. tomentosa Pursh, Fl., vol. 2, p. 319. 1814.

Type locality.—Banks of the Kooskoosky (Clearwater River, Idaho).

Range.—British Columbia to Saskatchewan and south to California, Arizona, New Mexico, and Kansas.

Zone.—Transition to Hudsonian.

Specimens examined.—Lake Tahoe, G. B. Grant, July 20, 1906; Glen Alpine, Tahoe, Dudley, June 28, 1900; Half-Moon Lake, Tahoe, 7,760 feet, McGregor 69.

2. **Achillea borealis** Bong., Mem. Acad. St. Petersb. VI, vol. 2, p. 149. 1832.

Type locality.—Sitka.

Range.—Subarctic America from Alaska to Labrador, south to eastern Quebec, in the Rocky Mountains of New Mexico, and on the Pacific Coast to California.

Zone.—Canadian to above timber line.

Specimens examined.—Silver Mountain, Alpine County, 10–11,000 feet, Brewer 2587; Cloud's Rest, Yosemite, Chesnut and Drew, July 12, 1889; Tuolumne meadows, Yosemite, dry gravelly pine forest, 8,650 feet, R. A. Ware 2700c.

According to Pollard[125] this species ranges along the mountain axis of Mexico to Central America.

23. TANACETUM

1. **Tanacetum canum** D. C. Eaton, *in* Wats., Bot. King's Exped., p. 179. 1871.

Sphaeromeria cana Heller, Muhl., vol. 1, p. 7. 1900.

Type locality.—"Limestone rocks at the mouth of a cañon in the East Humboldt Mountains, Nevada; 6,500 feet elevation."

Range.—Mountains of Nevada, west to the east slope of the Sierra Nevada and north to Stein's Mountains of Oregon.

Zone.—Arid Transition to Canadian; perhaps above.

Specimens examined.—Vicinity of Lundy, Mono County, 8–9,000 feet, Miss M. Minthorn; Mt. Dana, Congdon, August 11, 1898; Bloody Cañon, Mono County, Congdon, no. C 167; rocky slopes near Farewell Gap, Tulare County, 10,700 feet, Purpus 5203; Olancha Mountain, Tulare County, 10,000 feet, Rothrock.

24. ARTEMISIA

Plants shrubby.
  Most of the leaves 3-lobed or 3-parted, cuneate at the base; involucres 5–10 flowered.
    Most of the leaves merely lobed; heads very numerous; tall shrubs ....1. **A. tridentata**
    Most of the leaves 3-parted, the divisions obovate; heads fewer; low depressed high montane shrub ....2. **A. arbuscula**
  Most of the leaves entire; involucres 10–14 flowered.
    Pubescence loose and scurfy; leaves narrowly linear, acute, rarely lobed; heads about 14-flowered, numerous, often with long linear herbaceous bracts ....3. **A. Bolanderi**
    Pubescence of minute closely adhering hairs; leaves usually spatulate-lanceolate or linear, entire and obtuse, or sometimes 3-lobed; heads 10–14 flowered ....4. **A. Rothrockii**
Plants herbaceous or merely woody at base.
  Leaves soft-hairy, the basal finely divided into linear segments, the upper cauline reduced to trifid bracts ....5. **A. norvegica**
  Leaves green above, whitened below with cottony tomentum, cuneate, with 3 to 5 acute dentate lobes at the broad summit ....6. **A. Tilesii** var. **unalaschensis**

1. **Artemisia tridentata** Nutt., Trans. Am. Phil. Soc. II, vol. 7, p. 398. 1841.

Type locality.—"Plains of the Oregon, and Lewis River."

Range.—British Columbia to South Dakota, south to Lower California and New Mexico.

Zone.—Upper Sonoran, rising into the Canadian.

Specimens examined.—Tallac, Tahoe, Dudley, June 8, 1893; Suzy Lake trail, Tahoe, McGregor 197; near Summit Station, E. L. Greene, October 14, 1874; Angora Peak trail over the moraine south of Fallen Leaf Lake, Tahoe, 7,100 feet, Smiley 20; Mono Pass, Bolander 6150; Sonora trail, east side of the Sierra Nevada, Brewer 1863; Crescent Lake, Mariposa County, Congdon, August 14, 1895; mountain slopes along Little Kern River, Tulare County, 9,400 feet, Purpus 3001.

2. **Artemisia arbuscula** Nutt., Trans. Am. Phil. Soc. II, vol. 7, p. 398. 1841.

Type locality.—"On the arid plains of Upper California, on Lewis River."

Range.—Central Rocky Mountains west to Oregon and the Sierra Nevada.

Zone.—Upper Sonoran to Canadian at least.

Specimens examined.—Mt. Rose, 10,200 feet, Heller 9883; high on Mt. Stanford (Castle Peak), Hooker and Gray in 1877; high Sierras west of Summit Station, E. L. Greene 449; ridge south of

Donner Pass at 8,500 feet, Heller 7184; Ebbett's Pass, 8,500–9,000 feet, Brewer 1996; Silver Mountain, Alpine County, Hooker and Gray in 1877; rocky places near Mt. Olancha, Tulare County, 8–9,000 feet, Purpus 1868.

3. **Artemisia Bolanderi** Gray, Proc. Am. Acad., vol. 19, p. 49. 1884.

"*A. trifida* Nutt." of Bot. Calif., vol. 1, p. 405. 1876, in part, and not of Nuttall.

Type locality.—"Mono Pass, in the Sierra Nevada."

Range.—Not otherwise known than in the type.

Specimen examined.—Mono Pass, small shrubs, Bolander 6149 (type).

An obscure species or perhaps a hybrid between *A. Rothrockii* and *A. tridentata.*

4. **Artemisia Rothrockii** Gray, Bot. Calif., vol. 1, p. 618. 1876.

Type locality.—"Sierras of Tulare Co., Olancha Mountains and Monachay meadows, at 8,000 to 9,300 feet."

Range.—Sierra Nevada from Mono Pass southward to the mountains of southern California.

Zone.—Arid Transition to Canadian.

Specimens examined.—Mono Pass, Congdon, August 13, 1898; Mt. Dana, Bolander 6018; soda springs of the Tuolumne, Congdon, August 22, 1894; south side of Mt. Gibbs, Yosemite, 9,900 feet, Smiley 762; mountains near Soda Creek, Tulare County, 11,000 feet, Purpus 5165; foot of Mt. Olancha, Tulare County, 9,300 feet, Rothrock 343; Mt. Olancha, summit meadow at 9,500 feet, Hall and Babcock 5277; plains near Whitney meadows, Tulare County, 9–10,000 feet, Purpus 1565.

5. **Artemisia norvegica** Fries., Novit. Suec., ed. 1, p. 56. 1817.

A. Chamissoniana var. *saxitilis* Besser; *in* Hook, Fl. Bor. Am., vol. 1, p. 324. 1833.

Type locality.—European.

Range.—In North America from the mountains of British Columbia and Alberta south to Colorado and California.

Zone.—Hudsonian.

Specimens examined.—Mountains above Bear Valley, Placer County, 8,500 feet, Sonne, July 29, 1889; Pyramid Peak, Tahoe, 9,000 feet, Hall and Chandler 4751; north side of Wood's Peak, 9,000 feet, Brewer 2129; above head of Indian Cañon, Yosemite, Congdon, August 27, 1899; mountains near Little Kern River, 10–11,000 feet, Purpus 5205; Mineral King, Tulare County, T. S. Brandegee, July 28, 1892; Farewell Gap, Tulare County, 10,400 feet, Hall and Babcock 5659.

According to Dr. Rydberg, the plants here referred to *A. norvegica* Fries, as well as similar plants from the Rocky Mountains from Alberta to Colorado, should be assigned to *A. saxicola* Rydb. (Bull. Torr. Bot. Club, vol. 32, p. 128. 1905), which differs from the European plant described by Fries in having more numerous and smaller heads borne on shorter peduncles and in the greater development of the hairy pubescence. Examination of such European material as has been available for study seems to bear out Dr. Rydberg's statement as to the comparative size of the heads, though the degree of difference is in any case slight, but not as to the length of peduncles, while the differences in amount of pubescence appear to be determined by the date of collection, the older leaves being nearly or quite glabrate. For the reason that my opportunity to make adequate comparison of the Old and New World material was limited to a few sheets of the former, I am not now prepared to form an opinion as to the sum total of the slight differences, which Dr. Rydberg considers sufficient warrant for excluding *A. norvegica* Fries from North America. In any case, the plants here considered constitute a species common to both the Rocky Mountains and to the Sierra Nevada, but apparently absent from the northern Cascades.

6. **Artemisia Tilesii** var. **unalaschensis** Besser, Linnaea, vol. 15, p. 106. 1841.

Type locality.—"Ex insula Unalaschka."

Range.—Aleutian Islands to California.

Zone.—Canadian and Hudsonian.

Specimens examined.—Meadows at soda springs near Mono Pass, Bolander 6153; stony places near Little Kern River, 9–10,000 feet, Purpus 5168; dry mountain slopes above Hockett's meadows, Tulare County, 9,400 feet, Purpus 2095.

In the California material at least, this variety connects by a practically complete series of intermediates with *A. heterophylla* Nutt.

25. ANAPHALIS

1. **Anaphalis margaritacea** Benth. and Hook., Gen., vol. 2, p. 303. 1873.

Gnaphalium margaritaceum L., Sp. Pl., p. 850. 1753.

Type locality.—"Habitat in America septentrionalis, kamtschatca."

Range.—Northern Asia. Mountains of western North America eastward to Quebec and south to the Middle Atlantic States.

Zone.—Transition; in California occurring along the borders of the Canadian.

Specimens examined.—Mt. Dyer, Plumas County, Mrs. R. M. Austin 88; Gilmore Lake, west slope of Mt. Tallac, Tahoe, C. J. Fox Jr., July, 1895.

The two collections listed above are the only ones seen by me which appeared to be referable to the type form with narrow, revolute leaves permanently tomentose above. The common form in our region is the following variety, distinguished by broader, flat leaves, which are green and shining above and spreading at nearly right angles to the axis.

1a. **Anaphalis margaritacea** var. **occidentalis** Greene, Fl. Fran., p. 399. 1897.

Type locality.—Not given.

Range.—Coast Range of California north to Alaska. Sierra Nevada.

Zone.—Border of the Transition and Canadian.

Specimens examined.—Grass Lake, Tahoe, 7,200 feet, McGregor 93; Glen Alpine, Tahoe, 7,500 feet, Hall and Chandler 4648; above Donner Lake toward Donner Pass, Heller 7116; Upper Funston meadow, Tulare County, Hall and Babcock 5568.

26. ANTENNARIA

- Involucral bracts with green or brown tips.
  - Involucral bracts green, light colored at the tips; stems 2 to 3 inches high, rarely taller; leaves narrowly oblanceolate, abruptly acute; forming dense mats about and above timber-line .... 1. **A. media**
  - Involucral bracts yellowish to dull white; stems about 4 to 6 inches high; leaves broader and acuminate, blunt at the apex .... 2. **A. confinis**
- Involucral bracts not green or brown.
  - Involucral bracts rose colored at the tip, rarely whitish; stems 6 to 15 inches high; leaves linear, not cuspidate .... 3. **A. rosea**
  - Involucral bracts white at the tip, usually with a brownish center spot; stems 4 to 10 inches high; flexible stolons very abundant; leaves very narrowly linear, acute, and cuspidate .... 4. **A. corymbosa**

1. **Antennaria media** Greene, Pitt., vol. 3, p. 286. 1898.

A. pulchella Greene, Leaflets, vol. 2, p. 149. 1911.

Type locality.—"Mountains above Coldstream, Placer County, California."

Range.—High mountains of western North America from British Columbia and Alberta south to Colorado and California.

Zone.—Hudsonian and Arctic-alpine.

Specimens examined.—Frog Lake, Castle Peak, Sonne, July 31, 1897; Mt. Rose, 9,650 feet, Heller 9902b; Slide Mountain, Washoe County, Nevada, Heller 10962 in part; Pyramid Peak, Tahoe, 9,200 feet, Hall and Chandler 4740; Desolation Valley, Tahoe, McGregor 162; Mt. Rose, 10,000 feet, Kennedy 1149; Mt. Tallac, Tahoe, G. R. Hall, 8794; Ralston Peak, Tahoe, 9,000 feet, Smiley 419; Mono Pass, at summit and above, 10,700–11,000 feet, Brewer 1725; Mt. Dana, 12,200 feet, Smiley 728; same locality, at timber line, 10,300 feet, Hall and Babcock 3622; Mt. Gibbs, north side at 10,400 feet, Smiley 767; Mt. Goddard, 11,000 feet, Hall and Chandler 686; Cloud's Rest, Summit, Chesnut and Drew, July 12, 1889; Cathedral Peak, near Tuolumne meadows, 9,600 feet, Smiley 815; White Chief Mountain, near Mineral King, Tulare County, Culbertson (B 4505); southern high Sierra, Brewer 2830; Eagle Lake, Tulare County, 10,500 feet, Hall and Babcock 5366; Kearsarge Lakes, Tulare County, S. W. Austin, 557; mountains on Little Kern River, 10–11,000 feet, Purpus 5230.

This species is said by E. Nelson[126] to be too close to *A. umbrinella* Rydb. (Bull. Torr. Bot. Club, vol. 24, p. 302. 1897), described from "Long Baldy in the Little Belt Mountains," Montana, and he suggests that it may ultimately have to be regarded as only a dwarf form of that species, authentic material of which I have not seen. *A. umbrinella* is also a high mountain species and, according to Nelson, is nearer to the Arctic *A. alpina* Gaertn. than any other western Antennaria. *A. pulchella* Greene, founded upon *Hall* and *Chandler* 686 above cited, is described as differing from *A. media* mainly in the "subentire" tips to the pappus, but inspection of the cotype in U. C. disclosed the typical dilated tips with irregular contours of *A. media*. The plant referred to by Miss Eastwood[89] as having been collected on Harrison's Pass above timber line in the southern Sierra of Tulare County is of this species or possibly of the following variety.

1a. **Antennaria media** var. **ciliata** E. Nelson, Proc. U. S. Nat. Museum, vol. 23, p. 700. 1901.

Type locality.—"White Mountains, Mono County, California." Shockley 444.

I have seen no specimens of this variety, which is depauperate and beset with glandular-tipped hairs, from the Sierra; it is here included because *Coville* and *Funston* 2160 from Farewell Gap, Tulare County, is cited by Nelson.

2. **Antennaria confinis** Greene, Pitt., vol. 4, p. 40. 1899.

Type locality.—"Santa Catalina Mountains, Arizona." Lemmon.

Range.—According to Nelson (*l.c.*), from Idaho and eastern Oregon to Arizona, through the mountains of Nevada and along the east slope of the Sierra.

Zone.—Hudsonian?

I have seen no specimens from the Sierra which I could be sure were referable to this species, though *Baker* 1370 from Snow Valley, Ormsby County, Nevada, is possibly of this form. Nelson cites *Coville* and *Funston* 1658 from timber line on a divide northwest of Whitney meadows (now called Volcano meadows), Tulare County, as belonging to this species.

3. **Antennaria rosea** (D. C. Eaton) Greene, Pitt., vol. 3, p. 281. 1898.

A. dioica var. *rosea* D. C. Eaton *in* Wats., Bot. King's Exped., p. 286. 1871.

Type locality.—Not given, but no. 652, cited by Eaton as the basis of the variety, which is undescribed (i.e. nomen nudum), was collected in Colorado.

Range.—British Columbia to Alberta, south to Colorado and California.

Zone.—Transition and Canadian mainly, rising locally even above timber line.

Specimens examined.—Gold Lake, Sierra County, 6,400 feet, Hall and Babcock 4502; Donner Lake, Heller 6930, 7025; Suzy Lake, Tahoe, 7,650 feet, McGregor 104; Glen Alpine, Tahoe, Miss Lathrop, July 12, 1909; Carson Spur, Hansen 783; Marlette Lake, Washoe County, Nevada, 8,000 feet, Hall and Chandler 4580; Dana Fork meadows, Yosemite, 10,000 feet, Smiley 858; Cloud's Rest, Yosemite, Chesnut and Drew, July 18, 1889; Sawtooth Peak, Tulare County, 11,000 feet, Hall and Babcock 5691; Toowa Range, 9,000 feet, H. M. and G. R. Hall 8406.

3a. **Antennaria rosea** var. **angustifolia** E. Nels., Proc. U. S. Nat. Museum, vol. 23, p. 706. 1901.

A. angustifolia Rydb., Bull. Torr. Bot. Club, vol. 26, p. 546. 1890.

Type locality.—"Yosemite Valley." Torrey.

Range.—With the species but at somewhat higher elevations.

Zone.—Canadian and above.

Specimens examined.—Hills above Red Clover Valley, Heller and Kennedy 8699; Tuolumne meadows, Yosemite, 8,600 feet, R. A. Ware 2695c; Yosemite Creek and Indian Cañon to Porcupine Flat, 8,000 feet, Hall and Babcock 3477; Hockett's meadows, Tulare County, Culbertson (B 4465); mountain slopes along little Kern River, 10–11,000 feet, Purpus 5150; Mt. Dana, McLean, July, 1875.

The var. *angustifolia* is scarcely distinguishable when a large series of sheets is available for comparison; as a species, it is impossible, for, as Nelson wrote, when revising this section of the genus, "It grades so imperceptibly into *A. rosea* that its recognition as a species would not be justifiable." *Hall* and *Babcock* 647 from Glen Alpine, Tahoe, 7,500 feet, as represented in the Dudley Herbarium, is certainly of this narrow leaved form, but Nelson cites this number "in part" as an example of his var. *imbricata* (*l.c.*, p. 707), differing from the species in the broader leaves and more numerous bracts in the involucre. He also cites *Hall* and *Babcock* 5610 from Hockett's meadows, Tulare County, 8,500 feet, a collection not seen by me. I tentatively refer to the var. *imbricata* my own no. 85 from Desolation Valley, Tahoe, by reason of its broader leaves; the involucral bracts do not seem to be more numerous than in many of the specimens cited above as illustrating the species.

4. **Antennaria corymbosa** E. Nels., Bot. Gaz., vol. 27, p. 212. March, 1899.

A. nardina Greene, Pitt., vol. 4, p. 82. December, 1899.

Type locality.—"On a sunny slope at Battle Lake in the Sierra Madre Mountains" of Wyoming.

Range.—Wyoming and Colorado through Utah and Nevada to California.

Zone.—Canadian.

Specimens examined.—About Marlette Lake, Washoe County, Nevada, 2,460 m., Baker 1296; summit of Sierra Nevada, Kellogg in 1870; Bierstadt Peak, Tahoe, 7,500 feet, Davy 3227; Mt. Ralston, rare among granite rocks, 9,200 feet, Hall and Chandler 4684; Yosemite, McLean in June, 1875; Tenaya Lake, Yosemite, meadow south of the lake, 8,200 feet, Smiley 695; vicinity of Lake Tenaya, 8,200 feet, Hall and Babcock 3518; Tuolumne meadows, open sandy loam, 8,600 feet, R. A. Ware 2633c; Denel's Peak, Tulare County, 10,500 feet, Hall and Babcock 5518.

Gnaphalium palustre Nutt. (Trans. Am. Phil. Soc. II, vol. 7, p. 404. 1841), a small woolly annual, 1–6 inches high, is adventive about the shores of many small mountain lakes throughout the boreal region —Silver Lake, Amador County, 8,000 feet, Hansen 774; shores of Lake Tenaya, Yosemite, 8,100 feet, Smiley 874; Funston's Sheep Ranch, Tulare County, 10,000 feet, Culbertson (B 4675).

27. CIRSIUM

Leaves pinnatifid, white-woolly; subacaulescent; heads nearly sessile in the clump of basal leaves, whitish or sometimes purple flowered ....1. **C. Drummondii** var. **acaulescens**

Leaves toothed but scarcely pinnatifid, green above, woolly below; stems 1–3 feet high; heads bright red or pink, long peduncled ....2. **C. Andersonii**

1. **Cirsium Drummondii** var. **acaulescens** (Gray), comb. nov.

Cnicus Drummondii var. *acaulescens* Gray, Proc. Am. Acad., vol. 10, p. 40. 1874.
Cnicus tioganus Congdon, Erythea, vol. 7, p. 186. 1900.
Cirsium acaulescens K. Sch., *in* Just's Bot. Jahresb., vol. 29, pt. 1, p. 566. 1903.

Type locality.—"Rocky Mountains, and sparingly in the Sierra Nevada of California."

Range.—Yukon south along the Rocky Mountains to New Mexico, west to Oregon and southward in the Sierra Nevada to southern California.

Zone.—Transition and Canadian.

Specimens examined.—Little Truckee River, Sierra County, 6,300 feet, Hall and Babcock 4525; Hope Valley, Alpine County, 8,500 feet, Hansen 389; Suzy Lake, Tahoe, 7,800 feet, Smiley 178; foot of Mt. Dana, Congdon, August 11, 1898; Bloody Cañon, Mono County, Congdon 28; North Fork of Kern River, Coville and Funston 1714.

It is very doubtful if this form is sufficiently well marked from the typical form of the species to call for taxonomic notice, since it sometimes grows with the species and is then seen to pass directly into the specific form; the chief reason for distinguishing the variety is that it commonly grows at higher levels than the species, and in its zone of greatest frequency, the type state is rarely found.

2. **Cirsium Andersonii** (Gray) Petrak, Bot. Tidsskr., vol. 31, p. 68. 1911.

Cnicus Andersonii Gray, Proc. Am. Acad., vol. 10, p. 44. 1874.

Type locality.—"Sierra Nevada, California, and adjacent part of Nevada.

Range.—Sierra Nevada Region.

Zone.—Transition and Canadian, rising locally into the Hudsonian.

Specimens examined.—Near Donner Lake, Torrey 262; Glen Alpine, Tahoe, 6,800 feet, McGregor 135; south end of Fallen Leaf Lake, Tahoe, 6,400 feet, Hall 8770; near Marlette Peak, Washoe County, Nevada, 7,500 feet, Hall and Chandler 4576; Ebbett's Pass, Alpine County, 8,500–9,000 feet, Brewer 2001; Sky Valley, Tulare County, Culbertson (B 4679); mountain slopes on Little Kern River, 9–10,000 feet, Purpus 5060; base of Mt. Whitney, 11,500 feet, W. L. Kennedy 397.

28. PHALACROSERIS

1. **Phalacroseris Bolanderi** Gray, Proc. Am. Acad., vol. 7, p. 364. 1867.

Type locality.—"Westfall's meadows, above Yosemite Valley, alt. 8,000 feet."

Range.—Central Sierra Nevada.

Zone.—Canadian.

Specimens examined.—Peregoy's, wet meadows, Yosemite, A. Gray in 1875; same locality, 7,300 feet, Hall 9673; Shuteye Mountain, Madera County, Billy Brown's meadows, 6,800 feet, J. Murdoch Jr. 2574.

This species is the only one in the genus, the achenes being typically without pappus, though occasionally plants are found, whose achenes have a short coroniform pappus (var. *coronata* Hall, Yosemite Fl., p. 267. 1912).

29. MICROSERIS

1. **Microseris nutans** (Geyer) Schultz, Bip. Pollichia, vols. 22–24, p. 309. 1866.

Scorzonella nutans Geyer, *in* Hook., Lond. Jour. Bot., vol. 6, p. 253. 1847.
Calais nutans Gray, Pac. R.R. Rep., vol. 4, p. 112. 1857.
Ptilocalais nutans Greene, Bull. Calif. Acad., vol. 2, p. 54. 1886.

Type locality.—"Dry sunny loamy declivities of Spokane and Coeur d'Aleine Mountains."

Range.—British Columbia east to Montana and south to California and Colorado.

Zone.—Transition and Canadian.

Specimens examined.—Donner Pass, Heller 6977; Cisco, Kellogg, June 30, 1870; Grass Lake, Tahoe, McGregor 5; near Lily Lake, Tahoe, 6,600 feet, Smiley 390; Lake Valley, Tahoe, 6,400 feet, Abrams 4787; Glen Alpine, Tahoe, Setchell and Dobie, July 6–21, 1901; Porcupine Flat, Yosemite, 8,100 feet, Hall and Babcock 3633; high peak on the Tuolumne River, 10,000 feet, Brewer 1801; Tioga Road, Yosemite, 9,000 feet, R. A. Ware 2613c; vicinity of Tuolumne meadows, 8,500–9,500 feet, Hall and Babcock 3542.

30. AGOSERIS

Beak of the achene short and stout, gradually narrowing from the body of the achene .... **1. A. glauca**
Beak of the achene filiform, rather abruptly contracted from the achene .... **2. A. aurantiaca**

1. **Agoseris glauca** var. **laciniata** (Eaton), comb. nov.

Macrorhynchus glaucus var. *laciniatus* DC. Eaton, *in* Wats., Bot. King's Exped., p. 204. 1871.
Troximon glaucum var. *laciniatum* Gray, Bot. Calif., vol. 1, p. 437. 1876.
Agoseris monticola Greene, Pitt., vol. 4, p. 37. 1899.

Type locality.—Not given, the plant described from Colorado.

Range.—Rocky Mountains of Wyoming and Colorado, west to the Sierra and mountains of northern California.

Zone.—Canadian and Hudsonian, rarely above timber line.

Specimens examined.—Highest part of the Sierra near Summit Station, E. L. Greene 451; Summit, Bolander 1872; Sierra above Summit Valley, Pringle, September 27, 1882; shores of Heather Lake, Tahoe, 8,800 feet, Smiley 284; Carson Pass, 8,000 feet, Brewer 2113; headwaters of Stanislaus River, Alpine County, 7,500–8,000 feet, Hall and Chandler 4777; Lake Valley, Tahoe, 6,400 feet, Abrams 4784; lower end of Donner Lake, Heller 6991; Mt. Dana, 11,000 feet, Bolander 5042; Lyell Fork of the Tuolumne River, 8,600 feet, Hall and Babcock 3601; upper San Joaquin, Congdon, August 19, 1895; Summit Lake, Tulare County, Culbertson (B 4545); Farewell Gap, Tulare County, 10,000 feet, Purpus 5217; trail to Mt. Whitney, 8,000 feet, Culbertson (B 4421, 4422).

A. monticola is merely the form of the highest mountains, with scapes barely exceeding the leaves; the leaf outline varies from entire to deeply lobed with all possible intergrades.

2. **Agoseris aurantiaca** Greene, Pitt., vol. 2, p. 177. 1891.

Troximon aurantiacum Hook., Fl. Bor. Am., vol. 1, p. 300, pl. 104. 1833.

Type locality.—"Alpine prairies of the Rocky Mountains."

Range.—British Columbia east to Alberta and south to New Mexico and California.

Zone.—Canadian.

Specimens examined.—Dry hillsides above Suzy Lake, Tahoe, 7,800 feet, Smiley 163; Mt. Rose, east side at 8,450 feet, Heller, July 10, 1913; dry slope near White Wolf, Yosemite, 8,000 feet, Smiley 893.

31. CREPIS

Leaves glabrous and somewhat glaucous, obovate-spatulate, entire or shallowly lobed; achene dilated at the insertion of the soft pappus; dwarf alpine from running rootstocks .... 1. **C. nana**

Leaves pubescent, lanceolate in outline, pinnatifid or bipinnatifid with a long acuminate terminal lobe; stems rising from a stout perennial root .... 2. **C. occidentalis** var. **subacaulis**

1. **Crepis nana** Richards., Bot. App. Frankl. Jour., ed. 2, p. 757. 1823.

Type locality.—"On the Copper Mine River."

Range.—Subarctic America south to Colorado and California. Labrador.

Zone.—Arctic-alpine.

Specimens examined.—Sonora Pass, 10,000 feet, Brewer 1884; gravelly places near Farewell Gap, Tulare County, 10,600 feet, Purpus 5202.

2. **Crepis occidentalis** var. **subacaulis** Kellogg, Proc. Calif. Acad., vol. 5, p. 50. 1873.

C. occidentalis var. *nevadensis* Kellogg, *l.c.*
C. subacaulis Coville, Contr. Nat. Herb., vol. 3, p. 562. 1896.

Type locality.—"Found on the high peaks at Cisco, C. P. R.R., Sierra Nevada Mountains, about 7,000 feet."

Range.—Sierra Nevada to the mountains of southern California.

Zone.—Transition and lower Canadian.

Specimens examined.—Sierra Valley, Lemmon 80; Cisco, Brannan Jr., June 27, 1870; Castle Peak near the highest point, Heller 7086; Summit, Bolander and Kellogg in 1870.

The species is common in the Transition zone, often growing with the variety, which differs mainly in the absence of glandular hairs on the upper parts of the stems, these in the type being often viscid.

32. HIERACIUM

Flowers yellow; pappus fuscous or sordid.
  Stems short (4–12 inches high), numerous, leafy up to the cyme; pubescence of shaggy hairs; pappus fuscous ....1. **H. horridum**
  Stems taller, scapose, the leaves radical; pappus sordid.
    Radical leaves glabrous and green; heads small. 2. **H. gracile** var. **detonsum**
    Radical leaves pilose; heads larger ....3. **H. cynoglossoides** var. **nudicaule**
Flowers white; stems tall (1–3 feet), branching in the open cyme; leaves oblong, narrowing to a winged petiole; pappus whitish ....4. **H. albiflorum**

1. **Hieracium horridum** Fries, Epic. Hier., p. 154. 1862.

H. Breweri Gray, Proc. Am. Acad., vol. 6, p. 553. 1865.

Type locality.—"In montibus Californiae."

Range.—Mt. Shasta through the Sierra Nevada to the mountains of southern California.

Zone.—Transition to above timber line.

Specimens examined.—Mt. Rose, 9,700 feet, Heller 10331; Half-Moon Bay, Tahoe, Miss K. A. Chandler, August 21, 1901; Suzy Lake, Tahoe, 7,650 feet, McGregor 111; Pyramid Peak, east side, 9,500 feet, Smiley 126; Silver Mountain, Alpine County, 11,000 feet, Brewer 2048; Silver Valley, 7,350 feet, Brewer 1962; foot of Mt. Dana, Bolander 6131; Eagle Peak, Yosemite, Chesnut and Drew, July 6, 1887; Wawona Point, Mariposa County, A. Gray in 1872; Kaiser Crest, Fresno County, 9,600 feet, Smiley 648; Alta meadows, Tulare County, Mrs. Brandegee, August 21, 1905; Mt. Guyot, 11,500 feet, H. M. and G. R. Hall 8424; mountains near Little Kern River, Tulare County, 11–12,000 feet, Purpus 5141; Mt. Olancha, Tulare County, 10,400 feet, Rothrock 329; mountains near Kaweah River, Tulare County, 9–10,000 feet, Purpus 5160.

In alpine situations this plant becomes dwarfed and it is this state that is represented by Brewer 1962, 2048; by Purpus 5141; and by Hall 8424, which Dr. Gray described as *H. Breweri.*

2. **Hieracium gracile** Hook. var. **detonsum** Gray, Syn. Fl., vol. 1, pt. 2, p. 427. 1884.

H. triste var. *detonsum* Gray, Bot. Calif., vol. 1, p. 441. 1876.

Type locality.—"Ebbett's Pass, Sierra Nevada, at 8,000 feet (*Brewer*)."

Range.—Sierra Nevada northward to the mountains of southern Oregon and east to Colorado. Mountains of British Columbia, acc. Syn. Fl.

Zone.—Canadian.

Specimens examined.—Velma Lakes, Eldorado County, 8,000 feet, Hall 8806; Ebbett's Pass, 8,000 feet, Brewer 1983; Lake Tenaya, Yosemite, Congdon, August 14, 1894; meadows near Black Mountain, 9,500 feet, Fresno County, Hall and Chandler 599; Hockett's meadows, Tulare County, 8,400 feet, Hall and Babcock 5595.

The species ranges from Alaska to Oregon and Colorado and is characterized by the possession of copious black hairs upon the involucre, which in the variety are either absent or nearly so.

3. **Hieracium cynoglossoides** Arvet. var. **nudicaule** Gray, Proc. Am. Acad., vol. 19, p. 68. 1883.

Type locality.—"Northern portion of the Sierra Nevada, California."

Range.—From Lassen's Peak southward through the Sierra Nevada.

Zone.—Transition and Canadian.

Specimen examined.—Mt. Silliman, Tulare County, 9,000 feet, Mrs. Brandegee, August 24, 1905.

4. **Hieracium albiflorum** Hook., Fl. Bor. Am., vol. 1, p. 298. 1833.

Type locality.—"Rocky Mountains north of Smoking River, lat. 56°."

Range.—British Columbia east to Alberta and south to California and Colorado.

Zone.—Transition and Canadian.

Specimens examined.—Snow Valley, Ormsby County, Nevada, 2,460–2,615 m., Baker 1370; Glen Alpine, Tahoe, Setchell and Dobie, July 6–21, 1901; Silver Lake, Amador County, 7,200 feet, E. Mulliken 150; Nevada Falls trail, Yosemite, Congdon, July 2, 1885; Hockett's meadows, Tulare County, 8,500 feet, Hall and Babcock 5598; same locality, Culbertson (B 4435).

LIST OF NEW NAMES AND NEW COMBINATIONS

1. *Sitanion rigidum* var. *californicum* (J. G. Smith), comb. nov.
2. *Poa Pringlei* var. *Hanseni* (Scribn.), comb. nov.
3. *Scirpus yosemitanus,* sp. nov.
4. *Carex tahoensis,* sp. nov.
5. *Luzula spicata* var. nov.
6. *Brodiaea ixioides* var. *scabra* (Greene), comb. nov.
7. *Fritillaria gracillima,* sp. nov.
8. *Delphinium pauciflorum* var. *Sonnei* (Greene), comb. nov.
9. *Arabis Lyallii* var. *Davidsonii* (Greene), comb. nov.
10. *Sedum obtusatum* var. *Hallii* (Britton), comb. nov.
11. *Ribes hirtellum* var. *inerme* (Rydb.), comb. nov.
12. *Pyrus sitchensis* var. *californica* (Greene), comb. nov.
13. *Horkelia purpurascens* var. *pinetorum* (Coville), comb. nov.
14. *Acer glabrum* var. *Torreyi* (Greene), comb. nov.
15. *Acer glabrum* var. *diffusum* (Greene), comb. nov.
16. *Pentstemon procerus* forma *geniculatus* (Greene), comb. nov.
17. *Chrysothamnus nevadensis* var. *vulcanicus* (Greene), comb. nov.
18. *Erigeron nevadensis* var. *Sonnei* (Greene), comb. nov.
19. *Eriophyllum lanatum* var. *integrifolium* (Hook.), comb. nov.
20. *Arnica mollis* var. *scaberrima* (Greene), comb. nov.
21. *Agoseris glauca* var. *laciniata* (Eaton), comb. nov.

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